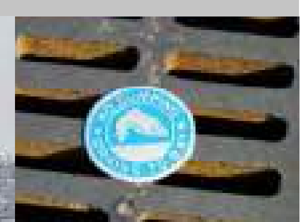
GREAT COVE WATERSHED MANAGEMENT PLAN TOWN OF ISLIP







Nelson, Pope & Voorhis, LLC
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GREAT COVE
WATERSHED MANAGEMENT PLAN

TOWN OF ISLIP

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NELSON POPE & VOORHIS LLC
ENVIRONMENTAL • PLANNING • CONSULTING

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Acknowledgements

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PREFACE

Long Island, New York. . . A land mass filled with people, commercial enterprise and natural resources, sitting on top of a freshwater aquifer and surrounded by marine waters. It's 2012 and we still dump untreated sewage into the ground, treated sewage into the ocean and stormwater into the ground and bays. Best management practices have been around for decades. It's time to take responsibility and ensure that measures are implemented that will continue a trend in water quality improvement.

It's true! Groundwater quality is improved as a result of the Southwest Sewer District, the bays are subject to less shellfish closures, and stormwater is being controlled more frequently before it overflows directly to the bay. But we can do better. There are still issues with overharvest of resources, illicit discharges, brown and red tides, loss of eel grass beds and overtaxing of resources. And, while there is a growing awareness of environmental issues, education of young and old alike is a critical area for improvement.

Link to the past. Retracing events that lead us to today's story provides an interesting and informative connection to the past. Not too many years ago, the estuaries were teeming with clams and finfish, wooden sailboats plied the bays, duck boats and hunters could be seen in the reeds, and trout filled the tributaries. Cold water streams and clean water bays were the norm and there was a balance between the co-existence of natural resources and man. Islip was a recreational paradise, and nearly all who lived there or visited, were linked with Great South Bay.

A popular place became populated. As population increased and more people discovered the treasure of Long Island's south shore, roads were built, developments sprang up, support businesses were established and the character of the area began an incremental change in the name of progress. There was little concern for the environmental response to anthropogenic change. Rivers became receptacles for stormwater and pipes were routed to the bay. Wetlands were filled and streams were culverted reducing the benefits of the plants adapted to watery environs. These plants take-up pollutants, prevent erosion, shade and cool the waters, and provide habitat for wildlife.

Economic reality/vitality. The bay was and is an economic engine. If the bay and its tributaries are compromised, so is our economic potential. The bay supported earlier aboriginal cultures and later settlers, and was the attraction that spurred 20th century development. The clam industry supported families and villages and had a major economic ripple effect throughout the south shore and beyond. Maritime recreation was the other part of the equation attracting fishermen, sailors, boaters and the like, resulting in marinas, boat sale and repair facilities, bait and tackle stores and a myriad of support businesses. And we love to be near the bay, so, restaurants, beaches, clam shacks, parks and other attractions enjoy a major boost in appeal that assures success. We need to protect the bay!

Can it be reversed? Yes, it's already started but we've got a long way to go. Wetland and environmental protection laws began to bring benefits by the mid-1970's. The concept of not filling wetlands and mitigating environmental impacts began to take hold. The practice of putting sanitary waste in the ground may be okay if you have a lot of land and not too many people, but sewage treatment is essential in populated areas. By the early 1980's, the Southwest Sewer District was treating the sanitary waste for much of the south shore, and the beneficial result is measurable in terms of reduced nitrogen levels in groundwater.

How do we continue to improve water quality? Guess what, it's not rocket science, but there's no magic bullet. There is much talk about being "green," ensuring sustainable growth and implementing low impact design. It mostly comes down to common sense. Big paved parking areas cause "heat effect," removing trees from a stream bank causes erosion and lower dissolved oxygen in the water, dumping too much untreated sewage causes our sole source aquifer to be non-potable, trees remove carbon dioxide and produce oxygen, and on and on. Once you understand the cause and effect, the solution becomes simple. Use plants and detention to remove pollutants from stormwater, "daylight" streams that are culverted, remove pavement where it's not needed and replace with landscaping, don't use too much fertilizer, don't litter, properly treat sewage, and on and on. We need to commit the funds and resources to make a series of small but important, incremental improvements to the watershed.

So sit back and enjoy the "read." You'll learn about the current status of environmental resources in the Great Cove area, and what can be done to improve these resources. You'll learn about what government, institutions and the private sector can do, and most importantly, what you can do, to protect our bays. And the good news is, you can still kayak, sail, fish, clam and swim in the bays, birdwatch, eat in the restaurants and reminisce about the proud maritime history that connects us with our ancestors and the abundant resources they enjoyed. Let's make them proud and leave a legacy for future generations where we are recognized for our stewardship of the Great Cove watershed and all that it has to offer.

Nelson, Pope & Voorhis, LLC
August 4, 2012

SUMMARY

EXECUTIVE SUMMARY

The Great Cove Watershed Management Plan (WMP) focuses on the drainage contributing area to Great Cove, which extends from just east of the Robert Moses Causeway to just west of Heckscher State Park and north above the Southern State Parkway. There are nine main creeks which contribute to Great Cove – (from west to east) Trues Creek, Thompsons Creek, Lawrence Creek, Watchogue Creek, Penataquit Creek, Awixa Creek, Orowoc Creek, Champlin Creek and Quintuck Creek (see **Figure 1-1**). The purpose of the WMP is to provide a characterization of the existing natural, cultural and human resources within the watershed, identify key factors impacting the Great Cove watershed, provide watershed-wide and site specific recommendations for watershed and water quality improvements, and provide implementation strategies for each of the watershed recommendations.

Section 2.0 of the WMP provides the characterization of the watershed. Resources detailed include geology, topography, soils, wetlands, rare, threatened and endangered species, cultural and historic sites, land use and water quality. Great Cove was historically an area which provided abundant commercial and recreational shellfishing opportunities, commercial and recreational finfishing opportunities, and significant habitats for various wildlife. Development of lands within the drainage contributing area to Great Cove has increased stormwater runoff and the pollutants carried in runoff. Review of land uses within the watershed indicate that well over fifty percent of the watershed is occupied by high intensity land uses, which are generally associated with an increase in stormwater runoff and therefore an increase in pollutants entering the creeks. In particular, review of water quality data revealed that pollutants in both surface and groundwater exceeded standards in at least some of data samples collected, indicating issues in pollutant inputs to each of the creeks.

Available water quality data was collected and summarized in **Section 2.2**. Review of the available data shows that all of the creeks have high levels of nutrients, such as phosphorus and nitrogen, which exceed the recommended guidelines for freshwater streams. As a result, there are regular algal blooms and low oxygen conditions in some of the creeks (e.g., Trues, Thompsons, Watchogue, Orowoc, and Champlin Creeks). High levels of bacteria (i.e., from pet waste, illicit boat discharges, leaky sewer pipes or large flocks of birds) exceeding established NYS Department of Health bathing beach standards are also common in some of the creeks (e.g., Trues, Penataquit and Orowoc Creeks). Elevated ammonia levels, an indicator of sewage, are also still a problem in many parts of the watershed. Chloride levels from road salting have steadily increased throughout the freshwater creeks and are especially high in the vicinity of the salt storage facilities near Penataquit Creek. Orowoc and Champlin Creeks were both former trout streams that in addition to nutrient impacts, have also suffered from elevated temperatures that become too warm for trout during summer months. Though temperatures have begun to decline in these streams, they still sometimes exceed critical temperatures known to limit trout growth. The available data indicates that all of the creeks within the study area have impairments, though some have shown signs of improvement since sewering in the early 1980's (see **Table 2-4 and Table 2-6**). There are several sources of pollution from which these high levels of nutrients are derived, with fertilizers and pet wastes in stormwater runoff, as well as the legacy effects of septic systems throughout the watershed, being the largest likely causes.

The overall goal of the WMP is to improve the water quality, natural resources, uses and educational programs within the watershed. The specific goals identified in achieving the overall goal for the watershed are identified as follows:

Water Quality Goals

- Improve water quality through the identification, control and reduction of non-point source pollution.
- Evaluate the existing inventory of stormwater infrastructure within the watershed and investigate pollution sources and major non-point source causes of water quality impairments. Establish a prioritization of recommended improvements/remediation.
- Prepare conceptual drainage improvement plans for fifteen priority stormwater impairment areas.

Natural Resource Goals

- Ensure protection of tidal and coastal freshwater wetlands for the benefits of water quality improvement, wildlife and anadromous fish habitat, marine food production, flood and storm control, open space and educational opportunities.
- Identify and protect important natural resources within the watershed.
- Restore wetland areas and wetland productivity where possible and appropriate.

Use Management Goals

- Maintain and promote appropriate water-dependent land use.
- Evaluate municipal operations and establish/promote best management practices to alleviate nonpoint source pollution.
- Improve and promote passive recreational and educational opportunities.

Educational Goals

- Promote environmental stewardship to increase awareness of watershed resources by partnering with existing organizations to sponsor programs and outreach efforts.
- Encourage and promote an understanding and appreciation of natural environmental resources and habitats of the Great Cove watershed.
- Improve water quality education by informing watershed residents and businesses of common activities that cause water quality issues and simple solutions to reduce impacts.

Thorough review of the characteristics of the watershed facilitated recommendations for watershed improvements, with a focus particularly on stormwater improvements to lessen nonpoint source pollution impacts on Great South Bay (see **Section 3.0**). Key recommendations are summarized below:

- Update Town regulations to incentivize the use of low impact development and green infrastructure for new development and redevelopment projects. Examples include: bioretention areas within parking lot areas, pavement reduction (reduced roadway widths, use of land banking for parking when appropriate, etc.), re-establishment of stream buffers, provisions to permit use of pervious pavement, etc.

- Implement Best Management Practices (BMP's) within Town facilities and Town infrastructure to reduce pollutant contribution from these facilities. Priority measures include:
  - Establish regular maintenance of storm drains, particularly inlets with direct overflows to surface water and from stormwater "hotspots" (parking areas, highway yards, hazardous material storage areas, etc.).
  - Educate Town maintenance personnel on the benefits of BMP practices, proper material storage and handling, and tracking of maintenance activities.
  - Complete periodic inventories of Town facilities for proper storage and containment practices, toxic and hazardous material handling and maintenance practices.
  - Reduce use of chloride-containing road deicers.
  - Seek funding for improvements (site specific improvements for Town facilities are described below).

- Establish partnerships and pursue funding for water quality monitoring to fill data gaps and facilitate tracking of the effectiveness of watershed management.
  - Initiate water quality monitoring for parameters of concern (such as temperature in Champlin Creek and sodium levels in Penataquit Creek).
  - Consider establishment of volunteer monitoring efforts.
  - Establish a central tracking system for any newly collected data.

- Integrate BMP practices into site planning review for industrial and other "hot spot" related uses during site plan review.

- Continue education & outreach efforts to effectuate public education as part of the Town's stormwater management program, Town representative interaction with the public, regulatory procedures, and outreach into the community through the Town's various departments.
  - enforce and facilitate proper use of marine sanitation devices by providing pumpout facilities at Town and private marinas & "no discharge zone" education and enforcement.
  - encourage "pick-up-after-your-pet" practices.
  - encourage the use of indigenous plants with low fertilization and irrigation requirements.
  - promote interest, increase stewardship of waterways and the "cause and effect" on water quality that daily actions may have..

Section 4.0 – Corrective Actions, identifies improvements for Town highway yard facilities and drainage improvement projects that would facilitate the recommendations provided in **Section**

3.0. These projects were conceptually designed utilizing detention, settling, infiltration, and filtration methods in order to decrease the peak stormwater flow rate and remove pollutants (e.g. oil and grease, metals, nutrients, sediment) from stormwater runoff. Drainage improvement projects were selected based on stream and water quality impairments, land use and impervious cover within contributing area, proximity of potential pollutant sources to the streams, and availability of publically owned land in proximity of streams for placement of drainage improvement projects. A summary of each of the 16 projects is provided below (see project locations and conceptual plans and details in **Appendix F**):

- Project 1 – Archie Place, Trues Pond: Create a biorention area in the triangle parcel and redirecting the existing direct discharges to the biorention area for filtration and pollutant removal prior to overflow into Trues Pond. Additionally, the northwest side of the Pond has small area of lawn which has adequate area to install an offline water quality treatment structure. The existing stormwater outfall would be directed to this subsurface water quality structure; which could provide for filtering of stormwater runoff through filter media, as well as removal of sediment, debris and floatables. Treated stormwater would then overflow to the existing stormwater outfall.

- Project 2 – Montauk Highway at Lawrence Creek: Consider one of two types of water quality treatment structures: 1) a simple baffle system collects sediment, floatables and hydrocarbons carried in stormwater runoff or 2) a water quality structure that includes filter media designed to additionally remove organics and nutrients.

- Project 3 – Town Housing Project, Penataquit Creek: Implement drainage improvements including the replacement of existing area drains and leaching pools, remove existing lawn fronting Penataquit Creek and replace it with a vegetated swale, and install a water quality treatment structure with high flow bypass at the existing catch basin in the northwest portion of the property (which is currently receiving off-site stormwater runoff).

- Project 4 – Mechanicville Road Parking Area, Watchogue Creek: Implement stormwater improvements including the removal of the existing direct discharge to Watchogue Creek via the grated inlet in the parking area, installation of subsurface leaching chambers or galleys in the central portion of the parking lot, and installation of a biorention area in the existing lawn area adjacent to the west of the Creek.

- Project 5 – Gibson St. Parking Area, Watchogue Creek: Implement stormwater improvements including the installation of a narrow stormwater biorention area in an area of existing striping (not currently used for parking), installation of permeable or porous pavement in a portion or throughout the parking lot, and installation of a diversion manhole to redirect stormwater runoff from the roadway conveyance system to a stormwater treatment structure

- Project 6 – South Shore Mall, Penataquit Creek: Improve both the salt storage practices and drainage infrastructure on the property including the establishment of a formalized and covered salt storage area with an elevated impervious floor to prevent runoff from entering the pile, establishment of linear biorention areas at each existing drainage inlet which directly discharges to the Penataquit Creek culvert, addition of smaller scale tree islands within the existing parking area and rain gardens to existing impervious plaza areas to increase subsurface infiltration of stormwater, disconnect rooftop runoff from the existing drainage conveyance system and reduce heat island effects, consider use of porous pavement in overflow parking areas, provide signage discussing the innovative green infrastructure improvements at the site, inspect existing on site recharge basins, remove accumulated sediment and plant supplemental vegetation as necessary to ensure dense vegetation within the basins and provide training for salt application and storage best management practices.

- Project 7 – 2nd Avenue Highway Yard: Implementation of the following good housekeeping procedures:
  - Retain and establish a regular monitoring and maintenance schedule for existing catch basin inserts to ensure proper functioning.
  - Install leaching pools to intercept stormwater from the existing positive overflow to provide for infiltration of stormwater and reduce runoff directed to Penataquit Creek.
  - Provide canopy for the existing fuel pump at the salt storage yard and install water treatment structure or catch basin insert at the existing inlet adjacent to the fueling pump.
  - Provide a truck washing area with independent collection and recycling of waste water (do not allow for overflow to existing drainage system in parking area).
  - Establish perimeter barriers for stockpile areas to avoid "creep" of stockpiles and spread of sediment within parking areas.
  - Establish regular maintenance schedule for collection and proper disposal of sediment within parking lot areas.

- Project 8 – Maple Avenue Parking Area, Watchogue Creek: The top of the bulkhead elevation should be raised and the parking lot re-graded to direct stormwater to newly established low points and drainage inlets within the parking area. Stormwater once collected should be directed to a water quality treatment structure designed with a high flow bypass to prevent flooding during large storm events.

- Project 9 – Oakwood Boulevard, Awixa Creek: Implement drainage improvements including redirection of stormwater from the direct outfalls at the road's crossing with Awixa Creek to a newly installed biorention area proposed within a small, Town-owned parcel on the south side of Oakwood Blvd.

- Project 10 – Saxon Cul-de-sac: It is recommended the paved center portion of cul-de-sacs with radii of 60 feet or more be evaluated for conversion to vegetated depressions for use in the storage/treatment of stormwater runoff. Breaks in the curb around the central island should be provided to allow for overland flow of stormwater into the central vegetated depression, or stormwater could be piped to the central island area from existing catch basins inlets.

- Project 11 – Orowoc Road Ends, Orowoc Creek: Implement drainage improvements including installation of catch basins at upland locations, installation of bio retention areas where feasible, and conversion of unused pavement for landscaped depression for stormwater treatment.

- Project 12 – Commack Road at Orowoc Creek: Implement drainage improvements including removal of the existing outfall on the north side of Commack Road and redirecting stormwater to a drainage manhole that would overflow to a newly installed biorention area proposed within the Town-owned parcel west of Orowoc Creek. Install a new drainage inlet on the south side of

Commack Road.

- Project 13 – Moffit Boulevard at Orowoc Creek: Implement drainage improvements including installation of low profile leaching systems to intercept stormwater from Moffit Blvd. east and west of the Creek and installation of bioretention areas if feasible.

- Project 14 – Fischer Park, Champlin Creek: Improve drainage within the park by intercepting stormwater from adjacent roadways which drain toward the Creek and providing either leaching pools or low profile leaching systems (in areas where there is minimal depth to groundwater) to recharge stormwater.

- Project 15 – Town DPW Yard at Champlin Creek: Implementation of the following good housekeeping procedures:
  - Relocate and provide covered storage of the salt pile as far as possible from Champlin Creek. The salt storage dome should be placed on an impervious pad with a rolled curb or similar method of containment.
  - Install leaching pools to intercept stormwater from the western access road and from within the paved portion of the yard (used for vehicle storage). Inlet filters or stormwater treatment structures should be considered in these areas to provide removal of oils and potential pollutants.
  - Establish perimeter barriers for stockpile areas to avoid “creep” of stockpiles and spread of sediment within parking areas.
  - Establish regular maintenance schedule for collection and proper disposal of sediment within parking lot areas.

- Project 16 – Brookwood Hall Park, Champlin Creek: Implement drainage improvements including installation of low profile leaching systems to intercept stormwater from Montauk Highway and provide drainage inlets to intercept stormwater along Montauk Highway east of the culvert over Champlin Creek and direct this runoff to a drainage depression with a vegetated settling basin in the southeast corner of Brookwood Hall Park.

An implementation strategy for recommended actions is provided in **Section 5.0**, including identification of responsible entities for each action. Corrective actions recommended in **Section 4.0** are prioritized and potential funding sources for each recommended action are provided. Additionally, order of magnitude cost estimates and a detailed description of actions eligible for various grant opportunities are identified.

The WMP is intended to provide guidance for future decisions regarding land use, management of Town facilities and environmental resource protection within the watershed. The development of this watershed management plan is a critical step in long-term protection of the Town’s water resources, which provide critical wildlife habitat, recreational opportunities, and strengthen the local economy. Key to the success of this plan is cooperative implementation at both a local and regional level to work towards specific plans for the protection and improvement of water quality within Great Cove and the Great South Bay.

SECTION 1

INTRODUCTION

1.0 INTRODUCTION

1.1 Background and Purpose

Great Cove is situated along the south shore of the Town Islip in Suffolk County, New York. Its contributing upland drainage areas (herein referred to as its watershed) are comprised of industrial, commercial and higher population suburban areas. Developed areas such as these are covered by buildings and pavement that do not allow infiltration of rain and snowmelt into the ground, but often rely on storm drains to carry large amounts of runoff from roofs and roads to nearby waterways. Pollutants from the land's surface are picked up by stormwater runoff (e.g. excess nutrients from fertilizers, bacteria from pet waste, and metals from vehicles) and transported into adjacent waterways. These non-point source pollutants are a problem for developed areas nationwide. The USEPA has identified polluted stormwater runoff as a leading cause of water quality impairment in our nation's waterways. The South Shore Estuary Comprehensive Management Plan (SSER CMP) has identified Great Cove's watershed as a priority non-point pollution contributing area within which pollutants from stormwater runoff should be controlled.

Great Cove was historically an area which provided abundant commercial and recreational shellfishing opportunities, commercial and recreational finfishing opportunities, and significant habitats for various wildlife. These resources have long been valued by the human population; however these resources have experienced significant decline in the last several decades. Not long after the population explosion experienced in Suffolk County in the 1950's, significant declines in shellfish and finfish began to occur. Fishermen could no longer catch shellfish and finfish in quantities to make fishing economically viable and pollutants found within shellfish rendered them inedible. Habitat loss and quality impairments also occurred due to filling of coastal wetlands and development within the watershed. The drainage contributing area to Great Cove extends from just east of the Robert Moses Causeway to just west of Heckscher State Park and north above the Southern State Parkway (see **Section 1.3** below). As development of lands within the drainage contributing area to Great Cove increased, the quantity of runoff from storms and the pollutants carried in runoff also increased, while the natural areas which aid in absorption and filtration of stormwater decreased. As a result, pollution inputs to Great Cove increased dramatically, which decreased the quality of the waters and habitats within Great Cove and its watershed. While the vast majority of the watershed is extensively developed, there are measures which can be taken to improve the water quality of Great Cove.

The combination of a large upland drainage area, numerous tributaries, upland land use characteristics, surface water configuration and characteristics indicate that stormwater improvements directed specifically at the Great Cove area will have substantial benefit in terms of shellfishing and recreational opportunities through overall water quality improvements. As recommended by the SSER CMP, this watershed management plan provides a framework to address water quality concerns in a commensurably agreed upon manner as decided upon through the Great Cove Watershed Advisory Committee, which is comprised of key state, municipal and local stakeholders. The outcome of the Watershed Management Plan (WMP) is a set of pollution preventative and corrective actions that include general best management practices, public education and outreach, stormwater improvement strategies, 15 specific target projects and priority actions.

In 2003, Nelson, Pope & Voorhis (NP&V) finalized a Stormwater Outfall and Conveyance Identification and Mitigation Plan for the Town of Islip that focused on identifying stormwater sources which direct runoff to the tributaries of Great South Bay. A significant outcome of the initial inventory and analysis work was the identification of Great Cove as a major influence on Great South Bay water quality. As part of the multi-year stormwater project, Great Cove was selected as a geographical subset and test area to develop a comprehensive stormwater management strategy within the Town. The Identification & Mitigation Plan included a detailed characterization of the problems and opportunities associated with stormwater outfalls in Great Cove as well as identified best management practices and fifteen specific stormwater abatement projects within the Great Cove area. None of these previously identified abatement projects have yet been implemented. The 2003 Stormwater Plan is being used as one of the many sources of existing information compiled for development of the WMP.

1.2 Goals and Objectives

The specific goals of the WMP were tailored based upon the goals and recommendations of the SSER CMP. They are organized into four major categories and are presented below.

- **Water Quality Goals**
  - Improve water quality through the identification, control and reduction of non-point source pollution.
  - Evaluate the existing inventory of stormwater infrastructure within the watershed and investigate pollution sources and major non-point source causes of water quality impairments. Establish a prioritization of recommended

improvements/remediation.
- Prepare conceptual drainage improvement plans for fifteen priority stormwater impairment areas.

■ **Natural Resource Goals**
- Ensure protection of tidal and coastal freshwater wetlands for the benefits of water quality improvement, wildlife and anadromous fish habitat, marine food production, flood and storm control, open space and educational opportunities.
- Identify and protect important natural resources within the watershed.
- Restore wetland areas and wetland productivity where possible and appropriate.

■ **Use Management Goals**
- Maintain and promote appropriate water-dependent land use.
- Evaluate municipal operations and establish/promote best management practices to alleviate nonpoint source pollution.
- Improve and promote passive recreational and educational opportunities.

■ **Educational Goals**
- Promote environmental stewardship to increase awareness of watershed resources by partnering with existing organizations to sponsor programs and outreach efforts.
- Encourage and promote an understanding and appreciation of natural environmental resources and habitats of the Great Cove watershed.
- Improve water quality education by informing watershed residents and businesses of common activities that cause water quality issues and simple solutions to reduce impacts.

Source: USEPA

1.3 Watershed Study Area

Great Cove is bounded on the west by the Bay Shore Marina peninsula and on the east by Bayberry Point. The overall watershed study area which drains into Great Cove totals approximately 11.5 square miles and is comprised of several hamlets – Bay Shore, Central Islip, East Islip, Islip Terrace, and the Village of Brightwaters. Among Islip's overall area which drains into Great South Bay, approximately 17 percent of the area specifically drains into Great Cove. There are nine main creeks which contribute to Great Cove – (from west to east) Trues Creek, Thompsons Creek, Lawrence Creek, Watchogue Creek, Penataquit Creek, Awixa Creek, Orowoc Creek, Champlin Creek and Quintuck Creek. A location map of the study area is provided in **Figure 1-1**. A map illustrating the individual watersheds of the overall study area is provided in **Figure 1-2**.

SECTION 2

CHARACTERIZATION

2.0 WATERSHED CHARACTERIZATION

2.1 Geologic Resources

2.1.1 Topography

Long Island is located within the Atlantic Coastal Plain, a physiographic province in which substantial sediment deposits overlie bedrock **(Fuller, 1914).** The surface topography primarily reflects the glacial history of the Island and subsequent human activity. The bedrock which underlies Long Island's Glacial, Magothy and Lloyd Aquifers slopes south and east at a rate of approximately 70 feet per mile, and the overlying sediments increase in thickness toward the south **(Jensen and Soren, 1974; Smolensky, et al., 1989).**

Topography within the watershed generally trends from north to south, with a maximum elevation of 109 feet located in the northernmost reaches of the watershed (see **Figure 2-1**). The greatest relief within the watershed occurs nearest to the creeks, which generally results in creek formation. The topography forming the individual watersheds within the Great Cove watershed are glacial meltwater features. Glacial advance during the Pleistocene Epoch resulted in the deposition of terminal moraines associated with the ridge in the center of the Island (Ronkonkoma Terminal Moraine) and the bluffs on Long Island's north shore (Harbor Hill Terminal Moraine). During glacial retreat, the meltwater from the glaciers formed meltwater swales resulting in river systems and topographic swales through the glacial outwash plain deposits south of the terminal moraine. This geologic origin formed the swale now occupied by the creeks located within the Great Cove watershed.

2.1.2 Soils

The USDA Soil Survey of Suffolk County, New York **(Warner et al., 1975)** provides a complete categorization, mapping and description of soil types found in Suffolk County. Soils are classified by similar characteristics and depositional history into soil series, which are in turn grouped into associations. These classifications are based on profiles of the surface soils down to the parent material, which is little changed by leaching or the action of plant roots. An understanding of soil character is important in environmental planning as it aids in determining vegetation type, slope, engineering properties and land use limitations. These descriptions are general, however, and soils can vary greatly within an area, particularly soils of glacial origin. The slope identifiers named in this subsection are generalized based upon regional soil types.

The Great Cove watershed study area is located within two of the Suffolk County Soil Associations, which are identified as the Haven-Riverhead association and the Riverhead-Plymouth–Carver association. The Haven Riverhead association is defined as "deep, nearly level to gently sloping, well-drained, medium textured and moderately coarse textured soils on outwash plains" while the Riverhead-Plymouth–Carver association is defined as "deep, nearly level to gently sloping, well-drained and excessively drained, moderately coarse textured and coarse textured soils on the southern outwash plain." Soils located within the Haven-Riverhead association are located within the northwest quadrant of the Great Cove watershed, while the remainder of the watershed consists of Riverhead-Plymouth-Carver association soils.

The predominant soil types located within the watershed as depicted in **Figure 2-2** consist of CuB (Cut and Fill land), PlA (Plymouth Loamy Sand), RdA (Riverhead Sandy Loam) and RhB (Riverhead and Haven soils), which are generally excessively drained to well drained. Significant quantities of Bd (Berryland Mucky Sand) Fd (Fill Land, Dredge Material) Fs (Fill Land, Sandy), HaA (Haven Loam), Mu (Muck), RdB (Riverhead Sandy Loam), Tm (Tidal Marsh), Ur (Urban Land) and We (Wareham Loamy Sand) are present within the watershed. Bd, Mu, Tm, and We soils are all poorly drained and are mainly located in areas adjacent to the individual creeks. Other soils present within the watershed include At (Atsion Sand), Bc (Beaches), CpA, CpC and CpE (Carver and Plymouth Sand), Gp (Gravel pits), Ma (Made Land), PlB and PlC (Plymouth Loamy Sand), Rc (Recharge Basin), Su (Sudbury Sandy Loam) and Wd (Walpole Sandy Loam). **Table 2-1** below provides a quantification of each soil type within the watershed in addition to the drainage category the soil type falls within.

Table 2-1
SOIL TYPES AND ABUNDANCE

Well Drained Soils		
Soil Type	**Acreage (±)**	**Percentage (±)**
At	21.26	0.13
Bc	3.56	0.02
CpA	8.89	0.18
CpC	6.63	0.04
CpE	2.90	0.02
CuB	1,923.17	11.89
CuC	2.29	0.01
De	99.66	0.62
Fd	189.18	1.17
Fs	595.03	3.68
Gp	53.91	0.33
HaA	529.88	3.28
Ma	78.37	0.48
PlA	873.15	5.40
PlB	148.49	0.92
PlC	23.58	0.15
Rc	17.98	0.11
RdA	3,236.22	20.01

Well Drained Soils		
RdB	233.67	1.44
RhB	6,054.18	37.44
Su	123.19	0.76
Ur	680.53	4.21
W	76.40	0.47
Wd	107.82	0.67
Poorly Drained Soils		
Soil Type	**Acreage (±)**	**Percentage (±)**
Bd	359.97	2.23
Mu	170.75	1.06
Tm	362.27	2.24
We	168.65	1.04
TOTAL	**16,171.58**	**100**

2.2 Water Resources

2.2.1 Surface Water

Great Cove is a coastal inlet which feeds into the larger middle portion of Great South Bay. It is situated between South Oyster Bay to the west and Nicoll Bay to the east. A substantial amount of information regarding the water quality of the tributaries which feed into Great Cove has been collected over the past several decades by Suffolk County Department of Health Services (SCDHS), the U.S. Geological Survey (USGS) and NYS Department of Environmental Conservation (NYSDEC) as part of their Rotating Intensive Basin System (RIBS), and most recently by Cornell Cooperative Extension and the volunteer-based Long Island Water Sentinels program. Surface water monitoring locations are identified in **Figure 2-3.** Data from these sources is summarized in the sections below.

Lakes and ponds can be classified according to trophic class (**Carlson & Simpson, 1996**) based upon index values such as chlorophyll and phosphorus. Each trophic class supports a different assemblage of organisms. Oligotrophic lakes have low levels of nutrients and low primary productivity, resulting in very clear waters with ample dissolved oxygen that support many fish species such as trout. Eutrophic lakes have high primary productivity due to excess nutrients that result in algal blooms and cause poor water quality. Bottom waters of these lakes and ponds are commonly low in oxygen, ranging from hypoxic (low oxygen) to anoxic (devoid of oxygen). Hypereutrophic lakes with very high concentrations of nutrients are susceptible to severe nuisance algal blooms with fish die-offs that may occur as a result of decomposing algae deoxygenating the water. The inland water bodies that occur along the creeks in the Great Cove watershed are considered to be eutrophic to hypereuthrophic due to the high levels of nutrients within them.

All of the creeks have high levels of nutrients, such as phosphorus and nitrogen, which exceed the recommended guidelines for freshwater streams. As a result, there are regular algal blooms and low oxygen conditions in some of the creeks (e.g., Trues, Thompsons, Watchogue, Orowoc, and Champlin Creeks). High levels of bacteria (i.e., from pet waste, illicit boat discharges, leaky sewer pipes or large flocks of birds) exceeding established NYS Department of Health bathing beach standards are also common in some of the creeks (e.g., Trues, Penataquit and Orowoc Creeks). Elevated ammonia levels, an indicator of sewage, are also still a problem in many parts of the watershed. Chloride levels from road salting have steadily increased throughout the freshwater creeks and are especially high in the vicinity of the salt storage facilities near Penataquit Creek. Orowoc and Champlin Creeks were both former trout streams that in addition to nutrient impacts, have also suffered from elevated temperatures that become too warm for trout during summer months. Though temperatures have begun to decline in these streams, they still sometimes exceed critical temperatures known to limit trout growth. Not a single creek can be issued a clean bill of health, though some have shown signs of improvement since sewering in the early 1980's. There are several sources of pollution from which these high levels of nutrients are derived, with fertilizers and pet wastes in stormwater runoff, as well as the legacy effects of septic systems throughout the watershed or sewer system overflows during significant rainfall events, being the largest likely causes. There have been reported occurrences of sections of the existing sewer system experiencing overflows from the sewer manholes, particularly during heavy rainfalls in low lying areas and areas of high groundwater. These sewer overflows are carried with stormwater into the street drainage conveyance systems, which in many cases discharge to nearby streams. These overflows are likely caused from either Infiltration and Inflow ("I&I") flow emanating from intrusion of groundwater (high water table and cracks/leaks in subsurface pipes) and illegal connections from basement sump pumps and stormwater sources.

The effects of pollution are far reaching. These creeks all empty into another valuable resource, Great Cove and the larger Great South Bay. Around Islip, the Bay has suffered from decades of pollution and over-fishing. Once bountiful fish and shellfish stocks have become depleted, and beach closures are not uncommon – particularly after heavy rainstorms. In order to protect and restore the waters from which we enjoy swimming, fishing, eating clams and oysters, and boating in, it is essential to reduce the amount of pollutants that enter Great Cove's waters.

2.2.1.1 Water Quality Criteria

The USEPA has published recommended nutrient criteria for ambient water quality in rivers and streams, as well as lakes and reservoirs according to ecoregions throughout the country. In response to USEPA's requirement that individual states must adopt nutrient criteria, New York is in the process of deriving its own state-specific criteria for wadeable rivers and streams, as well as ponded waters to protect the designated uses (best uses) of its waters (**NYS Nutrients Standards Plan, 2008**).

Nutrients: Nitrogen and Phosphorus

New York has an existing description of ambient water quality standard for nitrogen and phosphorus, as set forth in 6NYCRR 703.2. This standard sets limits for these two nutrients as

"None in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages." **Nitrate and nitrite** forms of nitrogen make up about 80 percent of the air we breathe and are naturally produced in nature. Nitrogren is an important constituent for water quality because it serves as an indicator of leaching from cesspools and other waste sources. Since **nitrate-nitrogen** is a major nutrient for all types of plankton and aquatic plants, it can stimulate excessive plant growth when other excess nutrients and favorable conditions simultaneously occur. Nitrates are a major component of lawn fertilizers and other sources which can be easily transported into streams and bays when it rains. Leaking sewer pipes, septic tanks, animal wastes (e.g. dogs, Canada geese), and car exhaust (oxides and nitrogen from combustion) all are major sources of excess nitrogen which enter waterways and cause water quality problems that can lead to unsightly conditions compromised aesthetics (e.g., unsightly conditions, odors) and direct and downstream impacts (fish kills, water quality impairment and resulting impact on recreation and fisheries). The NYS drinking water quality standard is 10 mg/L for nitrate and nitrite combined, but nitrate levels in enriched eutrophic lakes are typically between 0.5-1.5 mg/L. Over-enriched, hypereutrophic lakes generally have levels greater than 1.5 mg/L. Additionally, nitrate has been shown to impact the reproductive success of sensitive freshwater fish species when levels are above 2 mg/L, and can impact marine animals when above 20 mg/L (**Camargo et al., 2005**). Concerning **nitrite-nitrogen**, sensitive cold-water fish begin to be impacted when nitrite reaches 0.06 mg/L, and warm-water fish can generally tolerate nitrite levels up to 0.5 mg/L (**Hach, 2006**). The NYS surface water standard for **ammonia-nitrogen** is 2.0 mg/L. However, levels greater than 0.1 mg/L usually indicate polluted waters. It is toxic to fish and aquatic organisms at low concentrations – levels of 0.06 mg/L have been shown to begin to cause gill damage, levels of 0.2 mg/L are lethal to sensitive fish such as trout and salmon, and levels of 2.0 mg/L are lethal to ammonia-tolerant carp (**Hach, 2006**).

Phosphorus is necessary for plant and animal growth, but like nitrogen, it too is a component of fertilizers and domestic sewage (detergents) and can become excessive in water bodies, particularly in freshwater. Most healthy lakes have between 0.01 and 0.03 mg/L of phosphate-phosphorus, but levels above 0.025 mg/L can accelerate the eutrophication of lakes. The NYS Guidance Value for total phosphorus is 0.020 mg/L and applies to Class A, AA, A-S, AA-S, and B waters of ponds, lakes and reservoirs. However, the study area only contains lakes and ponds of Class C and SC, and streams of Class C(T) and C(TS). Therefore, the USEPA guidance value of 0.031 mg/L of phosphorus for rivers and streams was also utilized when assessing available water quality data.

Physical Parameters:
Fish and other aquatic wildlife need **dissolved oxygen (DO)** to breathe. Healthy DO levels in good fishing waters generally average about 9.0 mg/L. However, most fish begin to get stressed at about 5 mg/L of DO, and even the hardiest fish (e.g., bullhead) die when levels drop below 3 mg/L. The general NYS standard is 4 mg/L, but 5 mg/L for salmonids (e.g. trout). Excess nutrients combined with warm summer temperatures in a water body can lead to algal blooms which deplete DO from the water column when the algae die. Cooler waters are more effective at maintaining DO concentrations. Low levels of DO (hypoxia) and even no oxygen (anoxia) in the most severe cases, causes fish kills. The cycle of algal blooms, die-off, decay and utilization

of dissolved oxygen in this cycle is a problem for water quality. Consequently, maintaining DO levels is critical to support fish populations and recreational use as well as aesthetic enjoyment. **Powers of Hydrogen (pH)** measure the acidity (0 being strongly acidic) or basicity (14 being strongly basic) of water, with a pH of 7 being neutral. The NYS standard for pH in surface and groundwater is between 6.5 and 8.5. **Temperature** can vary in a water body depending upon the season, depth of the water, color, source (i.e. groundwater spring vs. stormwater runoff), water body volume, and whether heated effluents (i.e. from manufacturing or industry) are being discharged into the water. Fish migration is linked to water temperature. In early spring, rising water temperatures spur fish to migrate or begin spawning. In fall, dropping temperatures lead juvenile fish from estuaries out into the ocean or into rivers. Rainbow trout are very sensitive to increases in temperature. They will not spawn in waters above 8^{o}C (46^{o}F), fish growth stops at 15^{o}C (59^{o}F), and rainbow trout die at 24^{o}C (75^{o}F) (**Hach, 2006**). While overall, rainbow trout optimally occur in average water temperatures of 55^{o}F, warm water fish such as largemouth bass optimally occur at 23.5^{o}C (74^{o}F) but die above 34^{o}C (93^{o}F). Warm water also makes some substances more toxic for aquatic wildlife (e.g. phenol, zinc). **Sodium (Na)** is a metallic element that comprises salt in combination with chloride (Cl) ions. Though an essential element for all animal life, it can be toxic to plants and animals at high levels. The NYS standard for sodium is 20 mg/L. **Chloride (Cl)** is most commonly applied to roads in winter as a deicer and has been contributing to the salinizing of fresh water within the study area. Over the past several decades, its concentrations in streams throughout the country have been observed to steadily increase with the expansion of roads. Chloride is toxic to freshwater fish and other aquatic life at high concentrations, as well as can impact drinking water supplies for humans. It can affect the osmotic regulation of certain aquatic organisms, as well as also cause stratification of lakes by changing the density gradient and reducing the circulation and aeration of water at lower depths. The NYS standard for chloride is 250 mg/L.

A table summarizing the nutrient and physical criteria utilized to assess the available water quality data is provided in **Table 2-2. Table 2-3** provides a summary of water quality data in relation to water quality criteria.

2.2.1.2 Suffolk County FANS Study, Water Quality and Stream Conditions

The FANS study (**Suffolk County, 1980**) inventoried the ecology, aesthetics, recreation, socio-economics and water quality of each stream to numerically rank them according to their environmental value. Of the eight sampled streams within the Great Cove watershed, Champlin Creek was found to have the highest overall "Environmental Quality of Life Index," followed by Orowoc Creek, Cascade Lakes (above Brightwaters Canal), Penataquit Creek, Awixa Creek, Trues Creek, Lawrence Creek, Thompson's Creek and Watchogue Creek, respectively (see **Table 2-2**).

Stormwater pollutant load for each stream was also approximated (based on 1977 land use and pollutant load factors from the LI 208 study). Total stormwater pollutant loads for each stream's drainage area were ranked from greatest pollutant load to the least. Within the study area, Trues Creek had the largest estimated pollutant load, followed by Thompson's Creek, Cascade Lakes

(Brightwaters), Lawrence Creek, Watchogue Creek, Penataquit Creek, Awixa Creek, Orowoc Creek and Champlin Creek, respectively. These rankings also are summarized in **Table 2-2**.

Regarding overall flow, stream flow discharge categories were also determined, with Thompson's, Lawrence and Watchogue Creeks have less than 1 cubic foot second (cfs) of discharge. Awixa, Trues, Cascade Lakes and Orowoc-East Branch were grouped into the 1-5 cfs range. Penataquit, Champlin, and Orowoc-West Branch were grouped into the 5-10 cfs range. For comparison, the Connetquot and Carll's Rivers were grouped into the above 30 cfs range. One of the results of sewering with conveyance of discharge to the Southwest Sewer District ocean outfall in southwestern Suffolk County, was the expected decline in elevation of the water table due to an increase in consumptive water use and concurrent decrease in groundwater recharge. An outcome of this is decreased streamflow.

Water quality sampling revealed that there was no large variation in water quality among the streams in the study area. Within the Great Cove study area, the rankings found Champlin Creek to have the highest water quality, followed by Orowoc Creek, Awixa, Penataquit, Watchogue, Lawrence, Cascade Lakes, Thompson's Creek, and Trues Creek, respectively (see **Table 2-2**). As noted a summary of water quality criteria used to assess water quality data is provided in **Table 2-3**. Significant efforts were made to obtain and analyze available water quality data as part of this report. **Table 2-4** provides a summary of water quality data in relation to water quality criteria. Given that Trues Creek was considered to receive a slightly above average water quality rating compared to the other streams in the southwestern Suffolk County study area, Great Cove could be characterized as having above-average water quality input from its tributaries streams at the time of the April 1978 through May 1979 sampling period. Historical data showed trends of chloride, sodium, nitrate and sulfate concentrations increasing gradually over the time period from 1966 to 1976, while those parameters related to detergents decreased over the same time period.

TABLE 2-2
Rankings* from the FANS Study

Environmental Quality of Life Index	Estimated Stormwater Pollutant Load	Overall Water Quality
Champlin Creek	Trues Creek	Champlin Creek
Orowoc Creek	Thompson's Creek	Orowoc Creek
Cascade Lakes	Cascade Lakes	Awixa Creek
Penataquit Creek	Lawrence Creek	Penataquit Creek
Awixa Creek	Watchogue Creek	Watchogue Creek
Trues Creek	Penataquit Creek	Lawrence Creek
Lawrence Creek	Awixa Creek	Cascade Lakes
Thompson's Creek	Orowoc Creek	Thompson's Creek
Watchogue Creek	Champlin Creek	Trues Creek

*Ranked highest to lowest

TABLE 2-3
Summary of Water Quality Criteria

	Lakes and Reservoirs		Rivers and Streams		Other Guidance
Parameter	**NYS Guideline**	**USEPA Guideline**[1]	**NYS Guideline**	**USEPA Guideline**[1]	**Various Sources**
Total Phosphorus (TP) (mg/L)	0.020 [2]	0.008	-	0.031	
Total Nitrogen (TN) (mg/L)	-	0.32	-	0.71	10.0 (NYS drinking water standard) 0.45 (PEP standard for tidal waters)
Nitrate (NO_3) (mg/L)	-	-	-	-	2.0 (freshwater) 20 (saltwater) [3]
Nitrite (NO_2) (mg/L)	-	-	-	-	0.06 (coldwater) 0.5 (warm-water) [4]
Ammonia (NH_3) (mg/L)	2.0 (NYS standard)	-	2.0 (NYS standard)	-	0.2 (lethal to trout) 2.0 (lethal to carp) [5]
Chlorphyll a (Chl a) (µg/L)	-	2.90	-	3.75	
Dissolved Oxygen (mg/L)	4.0 (5.0 for trout)		4.0 (5.0 for trout)		
pH	6.5 - 8.5	6.5 - 9	6.5 - 8.5	6.5 - 9	6.5 - 8.5 (saltwater)[6]
Sodium (Na) (mg/L)	20		20		
Chloride (Cl) (mg/L)	250	230	250	230	500 mg/L is NYS groundwater criteria
Chlorine (Cl_2) (mg/L)	-	0.011	-	0.011	0.0075 (saltwater) [6]
Iron (Fe) (mg/L)	0.3	1.0	0.3	1.0	0.6 mg/L is NYS groundwater criteria
Bacteria (MPN/ 100 ml)	Total Coliform: = >5,000 [7] Fecal Coliform: = >1,000 [7] >2,400 [8]		Total Coliform: = >5,000 [7] Fecal Coliform: = >1,000 [7] >2,400 [8]		
Temperature	32.2°C(90°F) (nontrout waters) [9] 21.1°c (70°F) (trout waters) [9]		32.2°C(90°F) (nontrout waters) [9] 21.1°c (70°F) (trout waters) [9]		46°F (8°C) –rainbow trout stop spawning[10] 59°F (15°C) –trout growth stops [10] 74°F (23.5°C) – optimal for LM Bass [10] 75°F (24°C) – lethal to trout [10] 93°F (34°C) – lethal to LM Bass [10]

[1] USEPA criteria for Nutrient Ecoregion XIV, Eastern Coastal Plain (July 2002); USEPA National Recommended Water Quality Criteria (2009).
[2] NYS guideline for A, AA, A-S, AA-S and B waters of ponds, lakes and reservoirs. No guideline provided for C and SC waters.
[3] Nitrate impacts reproductive success for most sensitive freshwater species above 2mg/L for marine animals above 20 mg/L (Camargo, et al., 2005).
[4] Nitrite impacts to sensitive, cold-water fish (e.g. trout) begin at 0.06 mg/L; impacts to warm-water fish (e.g. bass) begin at 0.5 mg/L (Hach, 2006).
[5] Ammonia is lethal to trout at 0.2 mg/L and lethal to tolerant carp at 2.0 mg/L (Hach, 2006).
[6] USEPA National Criteria for saltwater (USEPA, 2009).
[7] NYS Department of Health Bathing Beach Criteria.
[8] NYS SPDES Permit Limits.
[9] NYS Water Quality Standards for thermal discharges in trout and nontrout waters, as per §704.2 of the ECL.
[10] Temperature sensitivity to trout and largemouth (LM) bass (Hach, 2006).

Table 2-4: Summary of Surface Water Quality Data

Stream		**Parameter** (Water quality rating as per criteria from **Table 2-2**: ○ - Never exceeds; ◑ - Sometimes exceeds; ● – Routinely exceeds)												
		TP (mg/L)	**TN (mg/L)**	**Nitrate (NO_3) (mg/L)**	**Nitrite (NO_2) (mg/L)**	**Ammonia (NH_3) (mg/L)**	**Chl a (ug/L)**	**Dissolved Oxygen (mg/L)**	**pH**	**Sodium (Na) (mg/L)**	**Chloride (Cl) (mg/L)**	**Bacteria (MPN/ 100 ml)**	**Tempe-rature (°C)**	**Comments**
	Criteria/ Guidance	Streams: 0.031 Lakes: 0.020	NYS: 10.0 EPA: 0.71	NYS: 10.0 Camargo: 2.0	Hach: 0.5 *Hach: 0.06 for Champ. & Orow*	NYS: 2.0 *Hach: 0.2 for Champ. & Orow*	EPA: 3.75	NYS: 4.0; *5.0 for trout in Champ.& Orow*	NYS: 6.5 to 8.5	NYS: 20	NYS: 250	Total: ≥5,000 Fecal: ≥1,000	32.2°C nontrout *21.1°C- trout Champ. & Orow*	
Trues Creek	**Pre-1980**	●	○ NYS ● EPA	○ NYS ○ Camargo	○	●	●	○	◑		○		○ <20°C	- 7 storm drains enter Trues Lake and are likely source of impacts. - Manganese and iron frequently violated NYS standards.
	Post-1980			○ NYS ◑ Camargo	○	●		●	●	○	○	●	○ ≤26°C	- USGS sampled 5x (1993-1995), but not for nutrients. - SCDHS sampled 18x (1986-2000).
Thompsons Creek	**Pre-1980**	◑	○ NYS ● EPA	○ NYS ● Camargo	○	●		◑	◑		○	○	○ ≤18°C	- Manganese and iron frequently violated NYS standards.
	Post-1980		○ NYS ● EPA	○ NYS ● Camargo	○	◑		●	●	◑	○	○	○ ≤20°C	- USGS sampled 3x (1993-1995), but not for nutrients. - SCDHS sampled 13x (1980-2000). - Significant decline in ammonia.
Lawrence Creek	**Pre-1980**	●	○ NYS ● EPA	○ NYS ○ Camargo	○	●	●	◑	◑		○	○	○ ≤27°C	- Manganese and iron frequently violated NYS standards.
	Post-1980	●	○ NYS ● EPA	○ NYS ● Camargo	○	○		○	○	●	○	○	○ ≤26°C	- SCDHS sampled 9x at 6 locations (1990-2000).
Watchogue Creek	**Pre-1980**	●	○ NYS ● EPA	○ NYS ● Camargo	○	●		●	◑		○	◑	○ <22°C	- Manganese and iron frequently violated NYS standards.
	Post-1980													- No further data collected.
***Penataquit Creek**	**Pre-1980**	◑	○ NYS ● EPA	○ NYS ● Camargo	○	○		◑	◑		○	◑	○ ≤20°C	- DO values somewhat lower in east tributary. - 2 salt storage sites were impacting water quality. - Manganese and iron frequently violated NYS standards.
	Post-1980	●	○ NYS ● EPA	○ NYS ● Camargo	○	○		○	●	●	◑	●	○ ≤20°C	- USGS sampled 66x (1980-1996). - SCDHS sampled 72x (1980-2000). - Stormwater and salt storage sites are still a problem – need improved BMPs.
***Awixa Creek**	**Pre-1980**	●	◑ NYS ● EPA	○ NYS ● Camargo	○	●	●	◑	○		○		○ ≤22°C	- DO values lowest downstream of STP (at former Town landfill). - Chloride violations only occurred in areas of tidal influence. - Manganese and iron frequently violated NYS standards.
	Post-1980	●	○ NYS ● EPA	○ NYS ◑ Camargo	○	◑		○	◑	●	○	●	○ ≤24°C	- USGS sampled 3x (1993-1995), but not for nutrients. - SCDHS sampled 13x (1980-1997).
[1]Orowoc Creek – W	**Pre-1980**	◑	○ NYS ● EPA	○ NYS ● Camargo	●	◑ NYS ● Hach	◑	◑	●		○	●	○ <21°C	- Manganese in stream frequently violated standards.
	Post-1980	◑	○ NYS ● EPA	○ NYS ● Camargo	◑	◑ NYS ● Hach		○	●	●	○	●	◑ <24°C	- USGS found elevated concentrations of tetrachloroethene. - SCDHS sampled 12x (1984-1997); DEC sampled 5x (1999). - DEC Bioassessment revealed moderate impairment (1994-2003).
[1]Orowoc Creek - E	**Pre-1980**	◑	○ NYS ● EPA	○ NYS ● Camargo	◑	◑ NYS ● Hach	●	◑	●		○	●	◑ ≤25°C	- Manganese in stream frequently violated standards
	Post-1980		○ NYS ● EPA		○	○ NYS ◑ Hach		●	●	●	○	●	◑ ≤25°C	- USGS found elevated 1,2,3-trichloropropane in tributary to Pardee's Pond; In the pond there was elevated tetrachloroethene, 1,1,-dichloroethene, 1,1,1-trhichloroethane & trichloroethene.
***[1]Champlin Creek**	**Pre-1980**	●	○ NYS ● EPA	○ NYS ● Camargo	◑	○ NYS ◑ Hach	◑	◑	●		○	○	◑ ≤23°C	- Low ammonia concentrations indicate direct sewage discharge is not a problem. - Manganese and iron frequently violated NYS standards.
	Post-1980	●	○ NYS ● EPA	○ NYS ● Camargo	○	○ NYS ◑ Hach		◑	●				○ ≤20°C	- USGS sampled 64x (1980-1996). - No SCDHS monitoring. - DEC Bioassessment revealed severe impairment in 1994; moderate
Quintuck Creek														- No data ever collected.

[1] Stream formerly supported naturally spawning trout populations; NYSDEC water quality classification indicate trout waters as a designated use, but Champlin and Orowoc have not been capable of supporting this designated use in recent decades.
*Indicates stream is included on NYSDEC 303(d) List of Impaired Waters.

2.2.1.3 USGS Stream Monitoring

The USGS has a total of nine surface water monitoring stations within the study area that have data from the 1980's or later. These occur on Trues Creek, Thompson's Creek, the Cascade Lakes at Brightwaters Canal, Penataquit, Awixa, Orowoc and Champlin Creeks. Relevant data is summarized below.

2.2.1.4 SCDHS Stream Monitoring

Suffolk County Department of Health Services continued to collect stream water quality data within the Great Cove study area through 2000 on the following Creeks – Trues Creek (2 sites), Thompson's Creek (1 site), Lawrence Creek (6 sites), Penataquit Creek (3 sites), Awixa Creek (1 site) and Orowoc Creek (4 sites).

A map of sampling locations is provided in **Figure 2-3**. Samples were collected at the stations over irregular time intervals in past years as time and resources allowed. Therefore, the number of samples collected at each station varies from as few as one (1) to sixty-two (62). As part of this study, the most recent stream water quality dataset was evaluated. Relevant data is summarized in **Section 2.2.1.6**.

2.2.1.5 NYSDEC Stream Monitoring

The NYSDEC samples fresh surface waters throughout the state on a rotating basis as part of their Rotating Intensive Basin Survey (RIBS) monitoring program. Both chemical and biological monitoring are conducted, though not necessarily at the same time or on the same water bodies. Orowoc Creek is the only stream in the Great Cove watershed which currently has available water quality data from the RIBS program. Biological water quality results based upon benthic macroinvertebrate assemblage testing as part of the RIBS program has only been conducted on Awixa, Orowoc and Champlin Creeks. Findings are also summarizedin **Section 2.2.1.6**.

The NYSDEC also monitors shellfish harvesting areas for water quality. Particularly in conditionally certified areas, water samples are collected throughout the year to determine whether the area is safe for harvesting of shellfish. **Figure 2-7** provides the general boundaries of the NYSDEC shellfish closure areas within the vicinity of the study area. Further discussion concerning the closure areas within Great Cove is provided in **Section 2.3.3**.

2.2.1.6 Summary of Water Quality Monitoring Data by Stream (West to East)

A narrative summarizing historic and most recent water quality monitoring data for each stream is provided below. **Table 2-3** provides a summary of water quality data in relation to water quality criteria.

Trues Creek

The FANS study characterized Trues Creek as having extremely slow flow, shallow depths (≤ 1 foot), and a streambed substrate predominantly composed of sand, silt and ooze. This system is comprised of two tributaries whose confluence is below Montauk Highway. Trues Pond occurs on the western branch. Stream flow along both branches of the creek was reduced to zero as a result of dewatering associated with sewer construction during the summer and early fall of 1978. Despite periodic drying, the system supports a high number of invertebrate types, many of which are intolerant of pollutant conditions. Fish, however, are limited within the creek due to shallow depths, but are relatively abundant in the pond. It was further characterized as representing a fairly balanced aquatic ecosystem. Trues Creek received a slightly above average water quality rating compared to the other FANS study area streams. Concentrations of ammonia in the stream system were greater than those for nitrate plus nitrite, indicative of domestic sewage. Total nitrogen reached a maximum of nearly 7.0 mg/L. Phosphorus concentrations ranged from approximately 0.008 to 0.096 mg/L and generally decreased in a downstream direction. The majority of phosphorus was thought to be derived from fertilizers and decomposing organic matter transported into the stream by stormwater flows. Dissolved oxygen was not observed to be less than 4.0 mg/L. However, in Trues Lake during the summer, dissolved oxygen ranged from anoxic (0.3 mg/L) to 13.5 mg/L as a result of algal photosynthesis and respiration. Nitrogen values were indicative of domestic sewage in close proximity to the lake.

Since the FANS study, the USGS sampled Trues Creek five times at the north side of Montauk Highway from 1986 through 2002. No nutrient data was collected, but August surface water temperatures were recorded to be 23.4^{o}C. Field pH was routinely below the NYS standard (pH of 6.1 both times sampled). SCDHS has also conducted sampling 18 times between 1986 and 2000 at the north side of Montauk Highway. Total coliform data exceeded the NYSDOH bathing beach criteria and NYSDEC surface water classification criteria of >5,000 MPN/100 ml once in 1995, but in 1994 and 1997, total coliform levels were at 5,000 MPN/100 ml (the maximum limit). Fecal coliform exceeded the NYSDOH bathing beach criteria (>1000 MPN/100 ml) 28% of the time (most recently in 1997), as well as surpassed SPDES permit limits (>2400 MPN/100 ml) on three occasions in 1994, 1995 and 1997. Ammonia levels continue to be astoundingly high since the FANS study, ranging from 0.190 to 3.400 mg/L, but the last two samples in 1997 and 2000 found lower concentrations of 0.190 and 0.238 mg/L, respectively. Nitrite has ranged from 0.014 to 0.030 mg/L. Nitrate + nitrite values were still relatively high, with a maximum of 3.44 mg/L in 1992, but the most recent sample in 1997 was 0.7 mg/L. Chloride concentrations ranged from 17 to 32 over the sampling period, indicative of moderate road salt impacts, but well below the NYS standard of 250 mg/L. Sodium levels have not violated the 20 mg/L NYS standard, but most closely approached the limit in 1990 with a concentration of 17.44 mg/L. Field pH and DO levels recorded in the 1980's and 1990's frequently dropped below NYS guidelines.

Summary:
Overall, Trues Creek has continued to show signs of being an impacted stream since the FANS sampling in 1978. Nitrate, chloride and temperature continue to uphold water quality standards. However, dissolved oxygen and pH levels appear to have worsened since 1980. Ammonia and total nitrogen have decreased since 1980, but still present problems. Ammonia continues to violate NYS standards, nitrate sometimes surpasses recommended guidelines, and bacteria routinely violate standards.

<u>Thompson's Creek</u>
Thompson's Creek was generally characterized as a tree-lined drainage ditch that borders the backyards of residential development. The small stream travels a short distance before becoming tidal. Flow is fairly slow, width rarely exceeds seven feet, depth is very shallow, and the substrate is primarily silt. Most notable is the undeveloped condition of the stream environs south of Montauk Highway. Thompson's Creek received a slightly above average water quality rating compared to the other FANS study area streams. Total nitrogen stayed below the NYS standard, ranging from 1.0 to 7.0 mg/L with ammonia and nitrate plus nitrite nitrogen each constituting approximately half of the total. However, ammonia routinely exceeded the NYS standard of 2.0 mg/L and reached a maximum of 4.3 mg/L, indicating contamination from cesspools and septic tanks. Nitrate was also routinely above the recommended 2.0 mg/L guideline for sustaining sensitive freshwater species. Phosphorus concentrations were low for all survey dates, averaging approximately 0.02 mg/L and typically below the USEPA recommended level of 0.031 mg/L with exception of a single sample. Dissolved oxygen ranged from 2.9 to 8.0 mg/L, sometimes falling below the 4.0 mg/L NYS standard for non-trout waters, and varied with respect to season and location. Also sometimes in violation of the 6.5 NYS standard, a low pH value of 5.6 during August was thought to be a result of the poor buffering capacity of the stream. Except for nitrate, ammonia and sulfate, the mean concentrations of water quality parameters were lower for Thompsons Creek than for the entire FANS study area.

Since the FANS study, Thompson's Creek was sampled 3 times at the north side of Montauk Highway by the USGS from 1993 through 1995, but no nutrient data were collected and there were no significant findings.

SCDHS has also conducted sampling 13 times between 1980 and 2000 at the north side of Montauk Highway. Total coliform data have not exceeded the NYSDOH bathing beach criteria or NYSDEC surface water classification criteria of >5,000 MPN/100 ml, but in 1995, total coliform levels were at 5,000 MPN/100 ml (the maximum limit). Fecal coliform levels have not exceeded the NYSDOH bathing beach criteria (>1000 MPN/100 ml). Ammonia levels were still astoundingly high soon after the FANS study (3.400 mg/L in 1980), but have significantly declined, measuring 0.200 mg/L in 1995 and 0.334 mg/L during the last sampling in 2000. Nitrite has ranged from 0.020 to 0.053 mg/L, remaining below recommended limits. Nitrate +

nitrite values were still relatively high, with a maximum of 3.48 mg/L in 1992, and the most recent sample in 1997 at 3.050 mg/L. Chloride concentrations ranged from 24 to 31 over the sampling period, indicative of some impacts from road salting. Sodium levels violated the 20 mg/L NYS standard in 1984 and 1985, but have dropped slightly in recent years to the lowest value of 15.6 mg/L in 2000. Field pH and DO levels from 1980 to 2000 frequently dropped below NYS guidelines.

Summary:
Overall, Thompsons Creek has shown little sign of improvement since the FANS study. Ammonia levels have significantly declined and now only sometimes violate NYS standards. Sodium levels also seem to have shown some decline. However, dissolved oxygen and pH seem to have worsened and more frequently fall below NYS standards.

Lawrence Creek
Lawrence Creek is generally comprised of O-co-nee and Lawrence Lakes, with its headwaters originating in the area of the LIRR and flowing through residential development before reaching O-co-nee Lake. The creek is covered and channelized under commercial development between the two lakes until just south of Montauk Highway, and then it becomes tidal below Lawrence Lake. The lake invertebrate communities are well represented and Lawrence Lake supports the more significant fish community of the two lakes. Depth becomes a limiting factor for many fish species in the upstream portions of the system. Lawrence Creek received an above average water quality rating compared to the other FANS study area streams. Observations suggest that the input of domestic sewage to the creek occurred primarily at the upper reaches and violations of standards for pH and dissolved oxygen were occasionally observed. Phosphorus concentrations in the stream and both of the lakes routinely exceed the USEPA-recommended value of 0.031 mg/L. Total nitrogen values stay well below NYS standards, but do routinely exceed the USEPA guidance value of 0.7 mg/L for aquatic health. Chlrophyll *a* values also routinely exceed the recommended USEPA guidelines of 3.75 ug/L. Ammonia values do frequently violate the 2.0 mg/L NYS standard, with Lawrence Lake being more often in compliance than O-co-nee Lake. O-co-nee Lake typically exhibited acceptable DO levels during summer sampling with only a few instances where it violated the 4.0 mg/L NYS standard, but displayed the ability to assimilate oxygen-depleted waters from its inlet. There is a potential for portions of the lake where depths are greater than five feet to become oxygen deficient. Lawrence Lake exhibited some evidence of DO and pH stress during August, but never decreased below the NYS DO standard. With the exception of phosphorus and iron, mean constituent levels were generally less in Lawrence Creek than other FANS streams.

USGS has not done any recent surface water monitoring of the creek, but SCDHS conducted sampling nine times at six locations above and below Montauk Highway between 1990 and 2000. No total coliform or fecal coliform results exceeded the NYSDOH bathing beach criteria or NYSDEC surface water classification criteria of >5,000 MPN/100 ml, but in 1992, total coliform levels at the south side of Cooper were at 5,000 MPN/100 ml (the maximum limit). Ammonia levels have been elevated, ranging from 0.02 mg/L in 1997 to 0.57 mg/L in 1992, but no longer exceed the NYS standard. The last sample in 2000 was recorded at 0.057 mg/L.

Nitrite was last recorded at 0.034 mg/L in 2000. Nitrate + nitrite values were still relatively high, with a maximum of 2.60 mg/L in 1990. Phosphorus concentrations continue to be a problem and routinely exceed the USEPA-recommended value of 0.031 mg/L. Chloride concentrations were somewhat elevated, ranging from 32 to 42 over the sampling period, but never violating the NYS standard. Sodium levels, however, routinely violated the 20 mg/L NYS standard during each sampling event except for one in 1997 when it was at the 20 mg/L limit. In 2000, all five locations sampled exceeded the 20 mg/L sodium limit with a maximum level of 23.9 mg/L. Field pH and DO levels have been within acceptable limits.

Summary:
Overall, Lawrence Creek has shown some signs of improvement, but still shows evidence of water quality impacts since the FANS study. Nitrogen values now uphold NYS standards, though total phosphorus and total nitrogen still exceed the USEPA recommended guidelines for healthy surface waters. Sodium also presents a problem frequently violating the NYS standard. On a positive note, dissolved oxygen and pH levels have also improved since 1980.

Watchogue Creek
The FANS study revealed that Watchogue Creek has water quality which is comparable to that of adjacent Lawrence and Penataquit Creeks. Total nitrogen stayed below the NYS standard, ranging from 3.5 to 5.7 mg/L, but well surpassed the recommended USEPA guideline of 0.71 mg/L for rivers and streams. Ammonia values frequently violated the NYS standard, averaging 2.54 mg/L and indicating contamination from cesspools and septic tanks. Nitrate was sometimes observed to be above the recommended 2.0 mg/L guideline for sustaining sensitive freshwater species. Phosphorus concentrations were also elevated, averaging 0.132 mg/L and frequently elevated above the USEPA recommended level of 0.031 mg/L. Dissolved oxygen frequently fell below the 4.0 mg/L NYS standard for non-trout waters. Observations of pH were also sometimes found to be in violation and below the NYS standard of 6.5. Elevated levels of bacteria in violation of NYS standards were also encountered. However, nitrite, surface water temperatures and chloride were never found to exceed NYS standards or recommended guidelines. Chloride concentrations averaged 31 mg/L (typical of the Great Cove study area).

Since the FANS study, there has been no surface water monitoring of this creek by USGS, NYSDEC or SCDHS.

Summary:
There is no way to know if Watchogue Creek has experienced any improvement in recent decades, as this creek has not been sampled since 1978 for the FANS Study. However, at that time, it represented a median in water quality within the Great Cove study area. The creek showed various signs of water quality impairment, particularly with regards to elevated levels of phosphorus, nitrogen and ammonia. Dissolved oxygen was frequently below NYS standard of 5.0 mg/L for non-trout waters, and pH was also sometimes in violation of NYS standards. Elevated levels of bacteria in violation of NYS standards were also encountered. This creek is in need of updated water quality monitoring information.

Penataquit Creek

The headwaters of this creek have changed very little since 1902, but the east branch was modified during the 1960's when a shopping mall was built on the stream channel north of Sunrise Highway. A 2600 foot underground culvert now carries this reach of the stream from the northern edge of the South Shore Mall to Sunrise Highway. Chloride concentrations at the headwaters of both branches were approximately 30 mg/L but increased downstream to a maximum of 83 mg/L. For most other streams in the study area, chloride concentrations generally decreased in the downstream direction as a result of dilution with less contaminated groundwater. The Penataquit Creek data indicate the presence of two salt storage sites (chloride sources) occurring within the drainage area, one maintained by the Town of Islip and the other by the South Shore Mall. The Town storage site is located on the western tributary and is the more likely source of chlorides to the stream. Runoff from the smaller site at the Mall which flows into the eastern tributary may contribute, but was determined to not be the primary cause of elevated chloride levels during the sampling period. The presence of the mall, however, alters the thermal conductivity of this area; temperatures were cooler during the summer and warmer during the fall than other sections of the stream. Phosphorus concentrations also generally increased downstream, sometimes surpassing the USEPA guideline (0.031 mg/L) and ranged from 0.002 to 0.093 mg/L. This trend was indicative of the downstream reaches of Penataquit Creek acting as a repository for organic matter and sediments, which subsequently decompose or disintegrate, releasing phosphorus in the process. Total nitrogen stayed below the NYS standard, ranging from 2.0 to 7.0 mg/L, however, total nitrogen and nitrate frequently surpassed the recommended guidelines for healthy aquatic systems. Though ammonia was generally high (ranging from 0.5 to 1.9 mg/L), it never violated the NYS standard. Dissolved Oxygen exhibited seasonal patterns, being lowest during the summer, and one violation of DO standards was observed in the east branch. Violations of standards for iron and manganese were frequently observed in surface water samples. With the exception of chloride, nitrate, and total phosphorus, the mean constituent levels were generally less in Penataquit Creek than those calculated for the entire FANS study area. The high concentrations of these three listed constituents appear to be related to the presence of a significant amount of commercial land use in the contributing area.

Since the FANS study, Penataquit Creek was sampled 66 times at the south side of Union Boulevard by the USGS from through 1996. Summer temperatures ranged from 14 to 20^{o}C. pH often dipped below the NYS standard of 6.5 and a minimum low of 4.9 was recorded in December 1985. Ammonia levels were relatively high, ranging from 0.6 to 1.0 mg/L, but lower than they were before 1980. Nitrite had a maximum concentration of 0.28 mg/L in 1982 but was generally less than 0.05 mg/L thereafter. Nitrate had a maximum concentration of 4.90 mg/L in 1980, but dropped thereafter with concentrations generally less than 4 mg/L. Phosphorus was observed to have a maximum concentration of 0.058 mg/L in September 1985, with levels dropping to generally 0.04 mg/L or less thereafter.

SCDHS has also conducted sampling 72 times between 1980 and 2000 at three locations (the south side of Sunrise Highway on the east branch, below the confluence on the north side of Union Boulevard, and the north side of Montauk Highway). At Montauk Highway, total coliform data have exceeded the NYSDOH bathing beach criteria and NYSDEC surface water classification criteria of >5,000 MPN/100 ml three times, most recently in 1996. Fecal coliform levels have exceeded the NYSDOH bathing beach criteria (>1000 MPN/100 ml) five out of seven times, most recently in 1996. Ammonia levels have been elevated, ranging from 0.025 mg/L in 1994 to 1.100 mg/L in 1980. The last sample in 1997 was recorded at 0.009 mg/L. Nitrite has remained relatively constant at 0.020 mg/L. Nitrate + nitrite values were still high, ranging from 2.9 mg/L in 1997 to 3.65 in 1992. Chloride concentrations were high, ranging from 46 to 69 mg/L over the sampling period. Sodium levels consistently violated the 20 mg/L NYS standard with a maximum of 37 mg/L in 1997. Field pH dropped below the NYS guideline in 1994.

At the north side of Union Boulevard, SCDHS total coliform data exceeded the NYSDOH bathing beach criteria and NYSDEC surface water classification criteria of > 5,000 MPN/100 ml six times, most recently in 1995, but the last sample in 2000 was at the 5,000 MPN limit. Fecal coliform levels exceeded the NYSDOH bathing beach criteria (>1000 MPN/100 ml) fifteen times, most recently in 2000. Ammonia levels were elevated but showed trends of decline, ranging from 0.110 mg/L in 1997 to 1.000 mg/L in 1987. Nitrite remained relatively constant, ranging from 0.020 mg/L to 0.043 mg/L, and most recently was measured at 0.034 mg/L in 2000. Nitrate + nitrite values were still high, ranging from 2.3 mg/L in 1999 to 3.9 in 1993. Chloride concentrations were high, ranging from 39 to 76 mg/L over the sampling period with one value exceeding the NYS standard (250 mg/L) at 252 mg/L in 2000. Sodium levels consistently violated and often doubled the 20 mg/L NYS standard with the highest value of 213.4 mg/L in 2000. Field pH often dropped below the NYS guideline.

Only one sample was taken by SCDHS at the south side of Sunrise Highway in 1989. Ammonia was elevated at 0.520 mg/L, as was nitrate (2.6 mg/L). Chloride was 49 mg/L and sodium violated the NYS Standard at 33 mg/L. Field pH and DO were within acceptable limits.

Summary:
Overall, Penataquit Creek has shown very few signs of water quality improvement and in many cases its water quality has worsened since 1980. Nitrogen values have shown some decline, though most recently observed nitrate values still nearly double the recommended guideline for sensitive freshwater species. Total phosphorus has been observed at lower concentrations, though it now more frequently exceeds the USEPA recommended guideline for healthy surface waters. Dissolved oxygen has continued to meet the NYS standard, but pH levels have not. Elevated levels of bacteria in violation of NYS standards were also frequently encountered.

Sodium presents a large problem, frequently more than double the 20 mg/L NYS standard and in one instance reaching a maximum concentration of 213.4 mg/L. Similarly chloride levels have also not improved, and on one occasion violated the NYS standard. Both the Town and South Shore Mall salt storage sites are in proximity to the creek and appear to continue to impact water quality by salinizing fresh water streams, making them toxic to aquatic life. Implementation of improved best management practices to limit the release of sodium and chloride into Penataquit from these two facilities is urgently needed.

<u>Awixa Creek</u>

The headwaters of this creek have shifted approximately 1,500 feet south of the original location in 1902. A lake existed in 1930 on the north side of Montauk Highway, where a shopping mall currently exists. Increases in chloride, conductivity, total nitrogen and ammonia were observed near the former Town landfill and outfall of the Islip Scavenger Treatment Plant (STP), a facility which accepted septic truck waste and which discharged treated cesspool effluent into Awixa Creek South of Sunrise Highway. Fertilizer use near the creek was also suspected to be causing elevated total phosphorus concentrations during the summer. Dissolved oxygen was found in generally adequate concentrations and pH appeared to be stable. Additional historical data revealed a trend of decreasing detergent concentrations from 1966 through 1975, likely reflecting the ban in 1971 on the use of these substances in Suffolk County and the alteration of the chemical formulation in 1965 of these substances by manufacturers. Violations of standards for dissolved oxygen were detected only during the summer, with the lowest concentrations occurring downstream of the STP. Montfort Lake is the significant lake on this creek. Tidal effects (e.g., highly elevated chloride concentrations) were evident on this lake, particularly during the late summer and early fall (a period of low precipitation). Low DO concentrations occurred within the lake during late summer and were accompanied by elevated nutrient concentrations. Short residence time prevents high rates of algal uptakes of nutrients. In the lake, violations of pH standards were detected and were likely due to the decomposition of organic matter; chloride and sulfate concentrations also occurred where there was evidence of tidal influence. Violations of fecal and total coliform standards were recorded in the monthly downstream and historical data. Iron and manganese violations were also frequently observed. The mean concentrations for water quality constituents in Awixa Creek were generally greater than those calculated for the entire FANS study area. Discharge from the sewage treatment plant and the presence of substantial tracts of commercial lands within the contributing area account for the poor surface water quality.

Since the FANS study, Awixa Creek was sampled three times at the south side of Montauk Highway by the USGS between 1993 and 1995, but no nutrient or temperature data was collected and the chemical testing which was performed yielded concentrations below detection value.

SCDHS sampled Awixa Creek 13 times between 1980 and 1997 at the south side of Montauk Highway. Total coliform data exceeded the NYSDOH bathing beach criteria and NYSDEC surface water classification criteria of >5,000 MPN/100 ml on three occasions in 1980, 1994 and 1995. In 1996 and 1997, total coliform levels were at 5,000 MPN/100 ml (the maximum limit). Fecal coliform exceeded the NYSDOH bathing beach criteria (>1000 MPN/100 ml) more than 50% of the time, as well as surpassed SPDES permit limits (>2400 MPN/100 ml) on two occasions in 1995 and 1997. Ammonia levels were astoundingly high from 1980-1990, ranging from 1 to 4.4 mg/L. The last two samples in 1996 and 1997 found lower concentrations of 0.29 and 0.22 mg/L, respectively. Nitrite most recently ranged from 0.03 to 0.06 mg/L from 1995 to 1997. Nitrate + nitrite values were still relatively high, ranging from a maximum of 3.71 mg/L in 1980 to 1.6 mg/L most recently in 1997. Phosphorus routinely continues to be above USEPA-recommended guidelines. Chloride concentrations were somewhat elevated, ranging from 30.0

to 44.4 mg/L over the sampling period, indicating moderate impacts from road salts. Sodium levels violated the 20 mg/L NYS standard during every sampling event and ranged from 21 to 30 mg/L. Field pH and DO levels recorded in the 1990's have improved to within NYS guidelines, but near the low end of each limit.

The NYSDEC RIBS program sampled the biological water quality of Awixa Creek in 2003 below the Union Boulevard Bridge. The assessment results of the benthic macroinvertebrate assemblage revealed the creek to have moderate water quality impairment.

Summary:
Overall, Awixa Creek has shown some signs of improvement since the FANS study, but still shows evidence of moderate water quality impacts. Phosphorus continues to routinely be elevated above USEPA-recommended guidelines. Nitrogen values more regularly meet NYS standards with ammonia having significantly decreased and only sometimes surpassing the NYS 2.0 mg/L limit. Total nitrogen and phosphorus still routinely exceed the USEPA recommended guidelines for healthy surface waters, but overall nitrate and ammonia concentrations have decreased. Sodium and bacteria are both problematic, frequently violating the NYS standards. On a positive note, no violations of dissolved oxygen standards have been observed, though pH levels still sometimes fall below the NYS standard.

<u>Orowoc Creek – West Branch</u>
This creek is comprised of a western and eastern branch. Orowoc Lake comprises the first stretch of the stream's western branch, and the stream then continues to the north side of the Southern State Parkway, where it is intermittent and empties into a stormwater impoundment before crossing the Southern State. South of the Parkway, the stream becomes more natural in appearance. The historic location of the headwaters began approximately 1,000 feet farther north, but the stream channel was obliterated during suburban development which followed World War II. Highly elevated levels of ammonia, conductivity and chloride concentrations were consistent indications of domestic sewage seeping into the stream. However, chloride never exceeded the NYS standard (250 mg/L). Ammonia only exceeded the NYS standard of 2.0 mg/L on one occasion at the northern-most station, but both ammonia and nitrite were consistently elevated above levels which have been known to impact sensitive coldwater fish such as trout. Similarly, total nitrogen was routinely elevated, and total phosphorus was sometimes elevated, above recommended USEPA guidelines for rivers and streams. Violations of DO standards were occasionally observed, but pH violations were frequently observed and most evident at the upper reaches of the stream during the summer. Fecal and total coliform violations were also recorded in the historical and monthly downstream data. Except for nitrate, the mean constituent levels were generally less in Orowoc Creek West than those calculated for the entire FANS study area. Iron and manganese were both found to frequently violate NYS standards.

Orowoc Lake exhibited some evidence of DO and pH stress during the summer, sometimes violating NYS standards during summer months. Fertilizers were implicated as a source of phosphorus. Total nitrogen, nitrate and ammonia never exceeded NYS standards, but routinely exceeded recommended guidelines for healthy streams. Total phosphorus also sometimes exceeded the recommended USEPA guideline of 0.031 mg/L.

Among all parameters measured within the stream and lake, chloride levels and temperature did not exceed recommended guidelines. Summer temperatures remained below 24ºC, a temperature which is known to be lethal to trout (**Hach, 2006**).

Following the 1980 FANS Study, the USGS sampled the western branch of Orowoc Creek three times between 1986 and 1994 at the south side of Moffitt Boulevard. No nutrient data was collected but chemical testing found an elevated concentration of tetrachloroethene at 2 ug/L (0.7 ug/L NYS TOG Limit) during two sampling events. SCDHS conducted sampling twelve times between 1984 and 1997 at the north side of Montauk Highway and north side of Moffitt Boulevard. Total coliform data frequently exceeded the NYSDOH bathing beach criteria and NYSDEC surface water classification criteria of >5,000 MPN/100 ml. Fecal coliform levels also frequently exceeded the NYSDOH bathing beach criteria (>1000 MPN/100 ml). Ammonia levels continued to be high but showed trends of decline since 1980, ranging from 0.03 mg/L in 1997 to 2.20 mg/L in 1980. Nitrite ranged from 0.030 to 0.072 mg/L during this period. Nitrate + nitrite values were still relatively high, with a maximum of 4.00 mg/L in 1993, and the most recent sample in 1997 at 3.60 mg/L. Chloride concentrations were moderate, ranging from 21 to 33 over the sampling period, but never exceeded the NYS standard. Sodium levels frequently violated the 20 mg/L NYS standard, most recently 22 mg/L in 1997. Field pH also frequently dropped below NYS guidelines.

The NYSDEC RIBS program sampled Orowoc Creek at Brook Street on five separate events during 1999 in April, June, July, September and October.. Ammonia levels were found to be consistently elevated (ranging from 0.157 to 0.561 mg/L) near recommended guidelines for trout streams, but never exceeded the NYS standard. Chloride was relatively constant, ranging from 22.1 to 26.2 mg/L and well below the NYS standard of 250 mg/L. Dissolved oxygen ranged from 6.3 to 10.3 mg/L and was within acceptable limits. Nitrate-nitrogen ranged from 4.41 to 4.76 mg/L and though well below the NYS standard for nitrogen in drinking water (10 mg/L), these elevated levels in a lake are indicative of over-enriched hypereutrophic waters. Nitrite-nitrogen ranged from 0.024 to 0.0643 mg/L. Cold-water fish begin to be impacted when nitrite reaches 0.06 mg/L. The field recorded pH values ranged from 5.8 to 6.7 and were 4 out of 5 times in violation of the NYS standard of 6.5 to 8.5. Sodium ranged from 18.5 to 22.5 mg/L and also frequently violated the NYS standard of 20 mg/L. Total phosphorus ranged from 0.0095 to 0.0233 mg/L, with the September sampling event surpassing the NYS Guidance Value of 0.020 mg/L. Levels above 0.025 mg/L can accelerate lake eutrophication and 0.1 mg/L is the general recommended maximum for rivers and streams. Temperatures ranged from 15.8^{o}C in April to 18.0^{o}C in July, 18.1^{o}C in September, and down to 12^{o}C in October. These waters are considered too warm for reproductive success of sensitive coldwater trout, which generally do not spawn in waters above 8^{o}C and for which growth stops at 15^{o}C, but are below 24^{o}C which is considered lethal to trout.

The NYSDEC RIBS program sampled the biological water quality of Orowoc Creek in 1994, 1998, 1999 and 2003 below the Moffitt Boulevard culvert. The assessment results of the benthic macroinvertebrate assemblage revealed the creek to have moderate impairment during all four sampling years.

Summary:
Overall, Orowoc Creek West has shown little change in water quality since the FANS sampling in 1978. Sodium has also been found to violate the NYS standard, and the USGS has found elevated concentrations of tetrachloroethene in surface water samples. However, nitrite, DO and temperature have shown some improvement. Nitrite levels have decreased and only sometimes surpass the recommended 0.06 mg/L guideline for trout streams. Since 1980, DO in the stream has not been recorded below acceptable limits. Temperature is still below lethal limits for trout, but sometimes still reaches 15^{o}C, a temperature known to limit the growth of trout. This former trout stream is still considered to be moderately impaired.

<u>Orowoc Creek – East Branch</u>
The eastern branch (also known as Doxee's Brook) does not extend as far north and terminates on the south side of the Southern State Parkway. The first section of the east branch nearest the mouth consists of two large ponds (Pardee's Ponds). The eastern branch is tidal south of Pardee's Pond. In 1980, the Pond and stream were characterized as having a diverse fish community. Nitrogen data suggested the input of domestic sewage to the creek, primarily at the upper reaches. Chloride never exceeded the NYS standard (250 mg/L), but levels averaging 24 mg/L are indicative of moderate impacts from road salt. Ammonia sometimes exceeded the NYS standard of 2.0 mg/L, and was consistently elevated above levels which have been known to impact trout. Similarly, total nitrogen was routinely elevated above USEPA guidelines, but below the NYS standard. Total phosphorus in the stream and ponds was sometimes elevated above recommended USEPA guidelines. Also in both the stream and the two ponds, violations of DO standards were sometimes observed and violations of pH standards were frequently observed during the summer months. DO violations were most prevalent at the upper reaches and in Lower Pardee's Pond. Iron and manganese were frequently observed to violate NYS standards. Summer temperatures in the stream sometimes exceeded 24^{o}C, a temperature which is known to be lethal to trout (**Hach, 2006**), but remained below this level in the pond.

Since the FANS study, SCDHS conducted sampling 9 times on the east branch between 1984 and 1997 (north side of Montauk Highway, north side of Moffitt Boulevard, and north side of Sunrise Highway). At the Moffitt Boulevard location, total coliform data did not exceed the NYSDOH bathing beach criteria or NYSDEC surface water classification criteria of >5,000 MPN/100 ml, but in 1995, total coliform levels were at 5,000 MPN/100 ml (the maximum limit). Also at Moffitt, fecal coliform levels exceeded the NYSDOH bathing beach criteria (>1000 MPN/100 ml) three out of five times. Ammonia levels continued to be elevated, ranging from 0.12 mg/L in 1985 to 0.42 mg/L in 1984 at Sunrise Highway, but below the NYS standard. The last sample in 2000 was recorded at 0.334 mg/L. Nitrite was consistently 0.03 mg/L or less. Nitrate + nitrite values were still relatively high, with a maximum of 3.48 mg/L in 1990. Chloride concentrations ranged from 25 to 39 over the sampling period. Sodium levels frequently violated the 20 mg/L NYS standard with a maximum of 23 mg/L in 1993. Field pH and DO levels frequently dropped below NYS guidelines.

USGS sampled the tributary to Pardee's Pond on the east branch above 42nd Street twice between 1993 and 1994. No nutrient data were collected but chemical testing found an elevated concentration of 1,2,3-trichloropropane at 1 ug/l (0.04 ug/L NYS TOG Limit). The USGS's sampling of Pardee's Pond once in 1986 at the south side of Montauk Highway also found elevated chemicals. Again, no nutrient data was collected but chemical testing found elevated concentrations of the following constituents: tetrachloroethene at 12 ug/L (0.7 ug/L NYS TOG Limit); 1,1-dichloroethene at 0.8 ug/l (0.7 ug/L NYS TOG Limit); 1,1,1-trichloroethane at 6.1 ug/l (5 ug/L NYS TOG Limit); and trichloroethene at 0.6 ug/L (5 ug/L NYS TOG Limit).

Summary:
Overall, Orowoc Creek East has shown little change in water quality since the FANS sampling in 1978. Sodium was found to violate the NYS standard, and the USGS found elevated concentrations of several chemical constituents in surface water samples. However, nitrite and ammonia showed some improvement. Nitrite levels remained below the recommended 0.06 mg/L guideline for trout streams. Ammonia only sometimes exceeded the recommended levels for trout streams. DO and pH, however, frequently were recorded in violation of NYS limits. Temperature once exceeded the lethal limit for trout, but routinely exceeded 15^{o}C during summer months, a temperature known to limit the growth of trout. This former trout stream is still considered to be moderately impaired.

<u>Champlin Creek</u>
The headwaters of Champlin Creek begin at the eastern end of Chestnut Street, above the Southern State Parkway and west of the Town and State Maintenance & Highway Facilities. Forested red maple swamp occurs in its mid-section, and most notable is a late succession bog between the Parkway and Spur Drive east of the creek's main stream. Its lower reach is characterized by three lakes: the smaller Duck's Lake (above Union Boulevard), Knapp's Lake (above Montauk Highway), and Winganhauppauge Lake (below Montauk Highway). Except at the upper reaches, total nitrogen concentrations were relatively constant, averaging approximately 3.5 mg/L. Though these concentrations were below the NYS standard, they were routinely above the USEPA guidelines for streams. Nitrogen in the upper reaches was thought to have been related to discharge from the Central Islip State Hospital (the hospital has since closed and the area redeveloped with NY Institute of Technology, the Long Island Ducks stadium, and residential apartments). Low concentrations of total nitrogen and ammonia overall suggested that seepage of domestic sewage into Champlin Creek was NOT significant; however, concentrations were still above current recommended guidelines for healthy aquatic systems. Phosphorus was observed at a maximum of 0.15 mg/L and was highest at the upper reaches. In conjunction with ammonia data, domestic sewage was not thought to be the source, but discharge from the Hospital or from decomposing organic material coupled with low flows were determined to be the likely causes. Temperatures in Champlin Creek exhibited a normal seasonal pattern and responded to changes in weather.

In the lakes, phosphorus concentrations increased slightly during summer and fall, likely having been generated from either lake sediments or derived from materials, fertilizers and organic matter on the land and washed in by stormwater flow. Two regions of the creek were susceptible to low oxygen concentrations – the upper reaches (DO < 5.0 mg/L during each sampling event), and the beginning of the lake region (< 6.0 mg/L). Although organic loading (and potential for oxygen depletion) was greatest in the lakes, the capacity of the larger lake waters (except for Duck's Lake) to assimilate organic matter was more than adequate. The 0.4-acre Duck's Lake exhibited DO stress during the summer months (less than the NYS standard) coupled with elevated nitrogen (though not from domestic sewage). Phosphorus levels were not believed to be high enough to promote nuisance conditions, but were suspected to have been generated by the lake sediments during the late summer as a result of low oxygen at the sediment-water interface or decomposing organic matter. Phosphorus levels were routinely elevated above the current NYS guideline for lakes (0.020 mg/L). Similar phosphorus patterns were observed in the other two lakes. Nitrogen sampling data indicated some minor direct inputs of domestic sewage into Knapp's Lake. Phosphorus concentrations being highest in the fall, its source was thought to have originated from decomposing leaves or other plant matter. In Upper Winganhauppauge Lake, there was no apparent significant input of domestic sewage, but phosphorus inputs during the spring were likely due to runoff from heavily fertilized lawns.

Historical data from 1966 to 1975 revealed water quality in Champlin Creek deteriorated as a result of continued urbanization. During the FANS study, direct discharge of sewage into Champlin Creek did not appear to be a major problem. Violations of standards for DO were observed in the upper reaches of the stream and in the two most upstream lakes during the early morning hours but recovered as the day and photosynthetic activity progressed. Manganese and iron concentrations were occasionally in violation of drinking water standards. Violations of pH standards occurred often and were particularly more acidic at the upper reaches during the spring. A comparison of water quality at the most downstream station of Champlin Creek with that for all of the downstream stations indicated the mean constituent levels were less in Champlin Creek than those for the entire FANS study area. This supports the findings that differences in water quality among individual stream systems can be related to the extent of urbanization.

Since the FANS study, USGS sampled Champlin Creek 64 times between 1980 and 1996 at the south side of Moffitt Boulevard at the boundary of Brookwood Hall Park. Temperature generally varied from 12 to 17^{o}C during summer months, with the highest temperatures recorded at 19.5^{o}C in 1988, 18^{o} C in June 1989, 19^{o} C in June 1992, 19.5^{o} C in 1993, and 20^{o} C in May 1994. Dissolved oxygen was generally above 5 mg/L, but frequently dipped between 4 and 5 mg/L between 1984 and 1986 with a low of 2.8 mg/L in 1985. DO generally improved thereafter with the exception of a 5.0 mg/L level recorded in August 1996. pH was lower than NYS standards during most sampling events reaching a low of 5.5 in March 1990. Ammonia was frequently elevated, ranged from 0.175 mg/L to a high of 1.100 mg/L in June 1983. Nitrite ranged from 0.011 in 1980 to 0.058 in 1983. Nitrate was very elevated with a maximum of 7.4 mg/L in 1980, then ranging from 1.9 to 3.6 mg/L. Phosphorus ranged from non-detectable to a high of 0.210 mg/L in June 1982, with typical concentrations generally less than 0.06 mg/L.

There are no SCDHS surface water sampling stations on Champlin Creek.

The NYSDEC RIBS program sampled the biological water quality of Champlin Creek in 1994, 1998 and 2003 below the Moffitt Boulevard culvert. The assessment results of the benthic macroinvertebrate assemblage in 1994 revealed the creek as being severely impaired, however, the following two sampling periods found improved conditions and the creek was assessed as moderately impaired.

Summary:
Overall, Champlin Creek has shown some improvement in water quality since the FANS study, particulary for nitrite. Nitrite levels decreased and remained below the recommended 0.06 mg/L guideline for trout streams. Ammonia, however, routinely exceeds recommended guidelines for trout streams. Phosphorus continued to exceed the USEPA recommended guidelines for streams. DO continued to sometimes fall below the NYS standard, and pH routinely fell below the NYS standard. Temperature ranges improved, no longer exceeding the NYS standard of 21.1^{o}C for trout waters (though this standard technically applies to discharges). Temperature, however, sometimes exceeded the 15^{o}C guideline known to impact trout growth (**Hach, 2006**). This former trout stream is still considered to be moderately impaired.

Quintuck Creek:
No water quality monitoring information is known to exist for Quintuck Creek. This tidal creek would be most similar to the waters of Great Cove due to daily tidal flushing. The collection of baseline water quality monitoring information is needed for this tributary.

2.2.1.7 SCDHS Tidal Water Quality Monitoring

SCDHS currently monitors one tidal station (Station 090190) in the center of Great Cove, approximately 0.65 miles south of the entrance to Penataquit Creek. This station has been continually monitored since 1985 and 573 samples had been collected through 2009.
Dissolved Oxygen concentrations are a signature parameter used to examine the vitality of an aquatic ecosystem. A review of 12 years of DO concentrations (1987-2009) showed that Great Cove has exhibited seasonally variable DO levels typical of temperate estuarine environments. Seasonal change in DO concentration is a function of changing temperature and salinity and is subject to the chemical, biological, and physical processes that occur in the embayment.

Table 2-5 below summarizes results of four constituents: 1) elevated levels of total coliform, 2) elevated levels of fecal coliform, 3) elevated levels of total nitrogen, and 4) below acceptable levels of dissolved oxygen. Results for these parameters are given as a percentage of the number of samples collected from the various locations (marine/estuarine, stream, and STPs) within each embayment area. To assess elevated levels of coliform bacteria in marine/estuarine and stream sites, NYSDEC criteria for shellfishing and surface waters (Class A, B, C, D, SB & SC), as well as New York State Department of Health (NYSDOH) criteria for bathing waters were utilized. For fecal coliform levels found at STPs, SPDES limits were applied. Standard criteria for nitrogen levels have yet to be developed for marine and estuarine waters. For purposes of comparison, the Peconic Estuary Program total nitrogen guideline (0.45 mg/l) was applied as a means to assess nitrogen levels in Great Cove. The benchmark used for dissolved oxygen was the New York State standard of 5.0 mg/l. Out of 550 samples, only 3 (0.5%) dipped below the NYS standard, with bottom waters reaching 4.5 mg/L in bottom waters on June 19, 2008 and a minimum of 3.9 mg/L on July 1, 2008. A level of 4.9 mg/L was observed on July 6, 2005. Otherwise dissolve oxygen levels have been within acceptable ranges, reaching a maximum of 13.4 and averaging 8.8 mg/L.

For the purposes of this surface water quality report, the analyses of nitrogen focus on Total Nitrogen (TN), Total Dissolved Nitrogen (TDN) and Total Dissolved Inorganic Nitrogen (TDIN). TN is routinely measured as an indicator of nutrient loading leading to eutrophication processes within estuarine systems. Ammonia (NH_3), nitrate (NO_3), and nitrite (NO_2) are all inorganic forms of nitrogen dissolved in aqueous solution. These compounds are accessible for plant uptake and in excess amounts promote algal blooms. TDIN was calculated for each sampling record by summing NH_3, NO_3 and NO_2. Total and Total Dissolved Kjeldahl Nitrogen (TKN and TDKN) are the summation of ammonium (NH_4) and organic nitrogen. Organic nitrogen comes primarily from protein in either dead or living cells. TN and TDN is the summation of inorganic and organic nitrogen components. Prior to August 2000, TN and TDN were calculated as the summation of NO_2 + NO_3 + TK[D]N. However, as of August 2000, this summation was no longer necessary as TKN and TDKN parameters were replaced with lab procedures that yield TN and TDN. Out of 301 samples of nitrogen collected at the station since 1985, 127 or 42.2% exceeded the 0.45 mg/l PEP guideline.

Out of 230 total coliform samples, 17.4% exceeded the NYSDEC shellfish criteria, but never bathing beach criteria. Out of 199 fecal coliform samples, 38.2% exceeded the NYSDEC shellfish criteria, but never exceeded bathing beach criteria.

Table 2-5
SCDHS Great Cove Tidal Monitoring Data
Percent of Samples Having Coliform, Dissolved Oxygen and Total Nitrogen Levels Beyond Available Criteria

% Samples Exceeding Total Coliform Criteria *		% Samples Exceeding Fecal Coliform Criteria **			% Having Low DO ***	% Having High TN +
Shellfish	Surface Water/ Beaches	Shellfish	SPDES	Beaches		
17.4	0	38.2	0	0	0.5	42.2

* NYSDEC shellfish criteria (not more than 10% of samples >230 MPN/100 ml); NYSDOH bathing beach criteria & NYSDEC surface waters classification criteria (not more than 20% of samples >5,000 MPN/100 ml)
** NYSDEC shellfish criteria (not more than 10% of samples >43 MPN/100 ml); NYSDOH bathing beach criteria (no samples >1,000 MPN/100 ml); SPDES permit limits (no samples >2400 MPN/100 ml)
*** Low DO defined as <5.0 mg/l (NYS standard) (3 samples)
\+ High TN defined as >0.45 mg/l (Peconic Estuary Program Guideline)

2.2.1.8 Cornell Cooperative Extension Outfall Monitoring

CCE was contracted by the Town of Islip in the fall of 2009 to conduct a one-year dry weather monitoring study below several outfalls within the Town. CCE is monitoring existing outfalls for dry weather flow to determine if any of these are illicit discharges. Once dry weather flow (DWF) monitoring is complete, CCE will then determine which outfalls should be sampled for water quality (e.g. turbidity, chlorine, potassium, ammonia, surfactants, salinity, pH, fecal coliform enumeration). The outfalls selected for water quality sampled will be based upon several factors, such as the following:

-presence and number of DWF occurrences
-relative flow rate of DWF
-proximity to potential illicit discharge sources (residences, commercial operations)
-qualitative data results from DWF monitoring
-waterbody priority (whether or not it discharges to a 303(d) waterbody
-likelihood of a flow being attributable to back-flow from ebbing tides
-likelihood of flow being attributable to groundwater intrusion
-field technician observations (e.g., observing emptying of a chlorinated pool)

-overall, the likelihood of an illicit discharge being present
-if it is requested by the Town

The data will be used to assess if a DWF is likely to be legal with respect to the State Pollutant Discharge Elimination System (SPDES) permit (e.g. groundwater intrusion) or if it is a potential illicit discharge. Results of the CCE study are not yet available.

2.2.1.9 Volunteer Water Quality Monitoring

The South Shore Estuary Learning Facilitator (sSELF) project was started in 2007 by Lou Siegel of the NYS Marine Education Association (NYSMEA) to encourage school and/or community groups to be active stewards of their local estuarine environment through education and water quality monitoring. The project is carried out in cooperation with the SSER Office, and has been supported by the ERM Foundation for the past four years. Increased scientific monitoring fostering citizen appreciation, education and stewardship are important objectives of the SSER Comprehensive Management Plan. Through the sSELF program, an Estuary Learning Facilitator visits interested schools and community groups, and then works with them to facilitate a monitoring/action project at a particular site of interest to the group. The sSelf program supplies the materials, equipment and training for group members. The program currently has several school groups, Boy and Girl Scout troops, teachers from Dowling College Noyce Scholars program, and the Freeport-based Operation SPLASH program in cooperation with the Nassau County Soil & Water Conservation District monitoring sites throughout the SSER watershed.

Since 2007, one group of interested high school students organized themselves as the *Great South Bay Buddies* and, supervised by one of the parents, has continually gathered a large amount of data in Brightwaters Lake and at the mouth and dam of the Brightwaters Canal. One of the Bay Buddies, Rachel Haberstroh of Bay Shore High School, conducted a separate research project on heavy metal pollution this past year with the assistance of members of the LI ERM Office. She has been monitoring Penataquit Canal. East Islip Middle School has also been monitoring Champlin Creek at Brookwood Hall since 2007. In 2008, Brendan Gaine conducted monitoring on Lawrence Creek. More than 400 separate data entries have been recorded on the sSELF database which is available online at *www.NYSMEA.org*. In 2011, monitoring began at Pardee's Ponds on the east branch of Orowoc Creek. In addition to studying nutrient and dissolved oxygen levels in the pond, some samples will be sent to Brookhaven National Lab to be analyzed for heavy metals.

In Lawrence Creek, a February 2008 sample recorded elevated pH and nitrite levels, which were early indications of impacts to be seen in the upcoming months. Of particular interest was data collected at three sites on the creek over eight different sampling events from July through September 2008. Top and bottom water quality samples from 9 to 23 feet depth of water revealed distinct stratification where surface samples were substantially warmer and contained much higher oxygen levels that the bottom samples which were severely hypoxic (very low levels of oxygen). On July 11, 2008 a serious hypoxic event was observed where even surface waters had < 2 mg/L of oxygen and bottom waters registered as low as 0.014. Massive die off of fish and benthic organisms would be expected at these levels.

At the mouth of Brightwaters Canal, nitrate levels were indicative of hypereutrophic waters, ammonia levels were indicative of pollution and phosphate levels were also elevated. Below the dam, nitrate and nitrite were similarly sometimes elevated. Phosphate and ammonia were frequently elevated, pH was sometimes below the NYS standard of 6.5 mg/L, and bottom DO levels were recorded to be < 5 mg/L on four separate occasions between the months of June and July during 2007 and 2008.

In Brightwaters Lake, ammonia levels were indicative of pollution and often reached 0.2 mg/L. Phosphate values were frequently high and pH levels were below NYS standards on several occasions. High densities of algae appear to occur and are indicative of excess nutrients in the system. At the mouth of Brightwaters Canal, nitrate levels are above desirable limits.

Penataquit Canal data reveals evidence of occasionally high nitrate and nitrite levels throughout the year. Phosphorus was routinely found to be high. Stressed oxygen levels (< 5 mg/L) were recorded at the surface during two sampling events in July 2007. These levels are likely the result of excess nutrients and warm temperatures which gave way to oxygen-depleting algal blooms.

On Champlin Creek, monitoring results at Brookwood Hall from December 2007 recorded elevated ammonia combined with high phosphorus, low pH, and in December 2007-January 2008 borderline levels of dissolved oxygen.

In 2009 with the cooperation of the sSELF program, the Long Island chapter of Sierra Club developed a parallel program called the Long Island Water Sentinels (*www.liwatersentinels.org*) and has expanded the sSELF monitoring program throughout Long Island waters. This new volunteer-based water quality monitoring initiative, started by Linda Freilich, has the goal of compiling baseline water quality data for both the North and South Shores of Long Island. The program trains and equips adult, teacher, and student volunteers to do team water testing in the field, ensuring reliable and accurate data. By December 2009, there were 8 teams of Sentinels monitoring and submitting data to the sSELF database. They currently do not have any monitoring sites within the Great Cove watershed.

2.2.2 Groundwater

The Great Cove contributing area is situated in a low-lying outwash plain with generally shallow depths to groundwater. Since 1980, the majority of the study area has been sewered as part of the Southwest Sewer District. Additional sewage treatment plants (STPs) are located outside of the Sewer District and just north of the overall watershed boundary in Bay Shore and Brentwood, but do not service the remainder of the study area. Therefore, northern portions of the study area above the Southern State Parkway utilize individual sanitary systems. The Sewer District boundary and nearby STPs are illustrated in **Figure 1-2**. The Great Cove watershed is entirely located within Suffolk County Groundwater Management Zone VII. A variety of groundwater monitoring has been historically conducted within the study area, which is summarized below.

2.2.2.1 Suffolk County FANS Study

Vastly expanding populations within the southwestern portion of Suffolk County in the late 1900's prompted the large-scale, federally-funded Flow Augmentation Needs Study to determine the potential impacts of sewering on tributaries of Great South Bay. For creeks, water quality data collected as part of this study is reported in **Section 2.2.16**. In 1980, a series of FANS on individual streams were completed (with the exception of Quintuck Creek) for the purposes of determining the effects of reduced groundwater discharge on stream flow from sewering throughout the Southwest Suffolk County Sewer District. Because groundwater discharge to streams accounts for most of the stream flow in the area (**Pluhowski and Kantrowitz, 1964**), a reduction in water table elevation and gradient was expected to result in less stream flow. Those streams with the most northern headwaters (e.g. Champlin and Orowoc Creeks with headwaters north of the Southern State Parkway) were expected to have the greatest impacts from reduced stream flow.

The FANS sampling program occurred from April 1978 through May 1979 and sampled groundwater as well as surface water throughout the study area to understand how area wastewater management plans may affect water resources. FANS field surveys included:

- groundwater monitoring at over 200 glacial well sites,
- stream surveys conducted at base flow during early summer, late summer/early fall, and late fall/winter,
- eutrophication (lake/pond) surveys conducted semi-monthly for a period of 8 months, and
- monthly monitoring of the station located at the outlet to Great South Bay.

Shallow groundwater observation wells included some sites chosen by the U.S. Geological Survey for the calibration of regional and subregional groundwater models. Additional wells were also installed and sampled in areas where USGS wells were sparse or where groundwater contamination was suspected. **Sgambat (1977**) determined that uncontaminated groundwater in

Babylon and Islip had chloride and nitrate concentrations of 6.0 and 2.2 mg/L respectively. This is higher than eastern Suffolk County groundwater samples from which uncontaminated water concentrations were generally 5.0 and 0.1 mg/L respectively (**Cohen, et al., 1968**). The mean concentrations for chloride and nitrate in the groundwater of northern and eastern Nassau County, which has been subjected to urbanization effects for a longer period of time than Suffolk County, were 83.0 and 4.3 mg/L, respectively (**Sgambat, 1977**). Comparatively, the mean concentration of total nitrogen and chloride for all the wells utilized in the FANS study was approximately 6.0 and 21.0 mg/L, respectively. In many of the wells during the FANS study, high concentrations of phosphorus did not coincide with high concentrations of total nitrogen, lending evidence that phosphorus detected in groundwater has a source other than domestic sewage. Urbanization was found to have significantly contributed to the deterioration of groundwater quality. Sewering would reduce the input of contaminants to the creeks via groundwater, particularly chloride and ammonia; however, the relative impact of contaminants derived from sewage when compared to those derived from non-point sources was not able to be determined.

Overall, relationships of contaminants to land use could be derived. The highest concentrations of contaminants were detected in wells located on non-residential land. The highest mean for chloride concentration (108 mg/L) was calculated for wells on commercial property. The highest mean for phosphorus concentration (0.20 mg/L) was calculated for wells on land designated for transportation. Both of these contaminants were lower on residential properties. Phosphorus concentrations of 0.1 mg/L are sufficient to cause nuisance conditions in nearby surface waters. The highest mean for ammonia concentration (4.8 mg/L) was calculated from wells on industrial property. Although maximum concentrations of contaminants were observed in wells designated other than residential, the input of contaminants from residential lands to the groundwater in the FANS study area still appears to be significant since, (1) the concentrations in these wells were greater than those estimated to be in un-altered water, and (2) the groundwater contributing area is overlain primarily by residential lands. With increasing population density, the concentrations of nitrate and oxygen decreased while those of ammonia increased. For the five residential categories, the highest chloride and phosphorus concentrations were associated with the highest population density. As population density increased, the concentrations of nitrate and oxygen decreased while those of ammonia increased. A summary of water quality findings for the individual inventoried creeks is provided below.

2.2.2.2 Suffolk County Comprehensive Water Resources Management Plan

The original Suffolk County Comprehensive Water Resources Management Plan (SCCWRMP) was completed in 1987. It provides information on water quality from 0 to 400 feet below the water table, based upon observation as well as public and private water supply and well monitoring. The 0-100 foot interval was provided as the "shallow" groundwater depth interval, and the 100-400 foot interval was provided as the "deep" groundwater depth interval. These were based primarily on available of data with private well data providing the majority of the data for the 0-100 foot interval, and public water supply wells providing data for 100-400 feet.

The study area is depicted as having good to marginal water quality with respect to nitrate-nitrogen (0-6 mg/l) at between 0 and 100 feet. Areas of marginal water quality (> 6-10 mg/l) were largely encountered in Bay Shore east of Brightwaters, as well as in the vicinity of Brentwood north of the Southern State Parkway. Several smaller areas of private wells north of Sunrise Highway throughout the study area also exhibited nitrate contamination exceeding the 10 mg/l drinking water standard. With regard to organic compounds, SCDHS water quality data presented in the SCCWRMP indicates that VOC levels at 0-100 feet below the water table vary in the study area with VOC levels generally good throughout most of the watershed (this category was created to represent generalized data where results were less than 60% of standard) and found not to exceed drinking water standards the majority of the time (per the category description in the SCCWRMP). Exceptions to this are areas of poor water quality in the vicinity of Bay Shore and East Islip south of Sunrise Highway, as well as a few smaller areas of private wells throughout the watershed (largely north of Sunrise Highway and in East Islip) where VOC contamination exceeded drinking water standards. For the "deep" interval, no elevated concentrations of nitrogen or VOC's were detected. Water quality data used in this study dates back to before 1987 and the source of contamination noted is not known.

More recently, the SCDHS conducted a study comparing levels of groundwater nitrogen below sewered versus unsewered areas along the south shore of Suffolk County (**Paulsen, 2008**). A small area of Bay Shore comprised of parcels all greater than one acre was one of the sewered sites assessed as part of the study. Lindenhurst and Copiague were two other sewered study sites located along the south shore which were included in the study and contained a predominance of high density residential parcels. Other areas with varying percentages of residential parcel sizes assessed as part of the study included unsewered areas of Yaphank, East Patchogue, Mastic and Speonk. This study concluded that in unsewered areas, higher density residential areas where the majority of parcels were one-half acre or less had higher concentrations of total nitrogen in the groundwater (~6-12 mg/L) as compared to lower density areas (3-5 mg/L). Sewered areas were shown to result in reduced levels of nitrogen in the groundwater, exhibiting an average of 2-5 mg/L as compared to 5-12 mg/L in unsewered areas.

The SCDHS is presently updating its SCCWRMP in order to reflect more recent development trends, resource plans and studies, and government programs and regulations pertinent to water supply and water resource protection. Task 15 of this update determined groundwater contributing areas to surface water (**CDM, 2009**) and provides useful information with respect to the study area. The determination of groundwater contributing areas was conducted by CDM using a regional groundwater flow model. **Figure 2-3** illustrates the draft groundwater contributing areas to Great South Bay. This is the most accurate determination of such contributing areas available, based on actual groundwater flow and subsurface outflow as determined using the regional groundwater flow model. It is noted that those areas identified in red adjacent to the shoreline and tributaries are located within the mapped 2-year travel time groundwater contributing area to the Great South Bay as depicted in the Task 15 draft updated contributing area boundary prepared for SCDHS in 2009.

2.2.2.3 USGS Groundwater Monitoring

The USGS has an extensive network of approximately 237 groundwater wells throughout the study area that were historically used for preparation of groundwater models and many of which were also used during the FANS study. However, the vast majority of the wells are decades old and have undergone minimal sampling in recent decades. Only approximately 40 wells in the vicinity of the study area have any current groundwater level monitoring or water quality data from within the past 30 years (see **Figure 2-3**). A summary of this data is provided below:

2.2.2.4 Summary of Water Quality Monitoring Data by Sub-area (West to East)

Extensive groundwater data is less widely available throughout the study area, particularly since the 1980 FANS study. However, the data which is available indicates a few interesting trends. Nitrogen, nitrate and ammonia values have significantly decreased within the subwatersheds of Penataquit, Orowoc and Champlin Creeks. This can be attributed to the extensive sewering of the watershed conducted circa 1980. Pre- and post-1980 data was not available to determine if similar trends existed in the other subwatersheds. Total phosphorus levels have also shown decline in the sub-areas of Penataquit and Champlin Creek. However, dissolved oxygen and pH within groundwater appears to have worsened watershed-wide, though it is not known why. In the Orowoc and Champlin Creek sub-areas, sodium impacts are evident.

Orowoc and Champlin Creeks were both former trout streams that in addition to nutrient impacts, have also suffered from elevated temperatures that during summer months become too warm for trout. Groundwater temperature readings associated with these two creeks were found to be alarmingly high during the FANS study (recorded as high as 86^{o}F in Orowoc and 77^{o}F in Champlin) as compared to temperatures in the range of 50^{o}F that would be typically be expected in the water table. The source of these elevated temperatures is unknown, however, the above-normal temperature water seeps into the creeks and impacts the ability of cold water fish within those creeks to thrive. Since 1980, groundwater temperatures have declined with those near Orowoc Creek recorded to be acceptable at <12^{o}C (54^{o}F). Near Champlin Creek, groundwater temperatures are still elevated (<21^{o}C, 70^{o}F) and exceed critical temperatures known to limit trout growth, but at least temperatures have declined to levels that are not lethal to trout (24^{o}C).

Narrative summaries of groundwater quality data for each of the creek sub-areas are provided below. **Table 2-6** provides a summary of groundwater quality data in relation to water quality criteria.

<u>Trues Creek</u>
During the FANS study, total nitrogen averaged 6.3 mg/L, but a maximum value of 15.0 mg/L (above the 10.0 mg/L NYS standard) was detected. Most of the nitrogen was in the form of ammonia, indicating proximity to major sources of sewage. Ammonia was very high, averaging 4.3 mg/L (more than double the 2.0 mg/L NYS standard). Chloride averaged approximately 28

mg/L and had a maximum concentration of 70 mg/L. Phosphorus was high, averaging 0.38 mg/L with a maximum level of 1.2 mg/L. For comparison, a concentration of 0.031 mg/L is recommended by the USEPA as the limit for healthy rivers and streams. Comparatively, phosphorus in domestic sewage typically ranges from 6 to 20 mg/L for weak to strong mixtures (**Metcalf and Eddy, 1972**). Domestic sewage, road salt runoff and a greater use of fertilizers than elsewhere in the study area were believed to have resulted in the observed high concentrations. Approximately 88% of its groundwater contributing area was residential in character with all sampled wells on residential land. Mean concentration of total nitrogen for residential land was comparable with those determined for the entire FANS study. The mean phosphorus concentrations in this subsystem were greater than those for the entire FANS study area, possibly indicating extensive application of fertilizer for lawn and garden maintenance in the contributing area.

Since the FANS study, USGS water quality monitoring has only been conducted at one well (S 1808.5) and it was limited to two samples taken in 2001 mainly for chemical constituents. Although no nutrient data was collected, dissolved oxygen (1.6 mg/L) and pH (5.8) measured on one occasion were both found to be below NYS standards. No alarming levels of pesticides or other chemicals were recorded.

<u>Thompson's Creek</u>

During the FANS study, nitrogen values were all found to be below NYS standards. Total nitrogen averaged 3.1 mg/L, most of which was in the form of nitrate (averaged 2.6 mg/L). The low concentration of ammonia nitrogen in both wells (averaging 0.445 mg/L) was indicative of very little contamination due to domestic sewage. Chloride concentrations averaged 54.5 mg/L and ranged from 24 to 85 mg/L with one well being more influence from road salt runoff than the other. Though well below the 250 mg/L NYS standard, these concentrations indicate moderate impacts from road salt. Phosphorus concentrations averaged 0.038 mg/L among both wells, suggesting that the use of lawn and garden fertilizers in the immediate area of the wells was minimal in comparison to other parts of the study area. Approximately 60% of its groundwater contributing area was residential in character with both sampled wells on medium density residential land. Contamination of the groundwater in this subsystem was primarily due to seepage from cesspools and septic tanks, but chloride levels also indicated presence of road salt runoff.

There has been no additional groundwater well water quality monitoring since the FANS study.

<u>Lawrence Creek</u>

A maximum total nitrogen value of 25.1 mg/L was detected, most of which was in the form of nitrate, implying that the well was located relatively close to a major source of contamination and oxygen concentrations in the groundwater in this area at the time were not sufficient to permit nitrification to occur. Chloride concentrations averaged 37.8 mg/L and a maximum chloride concentration of 120 mg/L in one well indicated significant influence from road salt runoff which may be reflective of the close proximity of this well to Montauk Highway. Chloride concentrations in the other three wells were relatively uniform at approximately 21 mg/L. Total nitrogen, nitrate and ammonia routinely violated NYS standards, with total nitrogen averaging 10.68 mg/L and reaching a maximum of 25.11 mg/L. Ammonia was very high, averaging 3.6 mg/L and reaching a maximum of 7.2 mg/L. Chloride-to-nitrogen ratios in the majority of the wells were comparable to that commonly measured in domestic sewage, indicating this contaminant is a significant source of contaminants in the Lawrence Creek subsystem. Phosphorus concentrations observed averaged 0.11 mg/L and in one well reached a maximum of 0.30 mg/L, but the nitrogen concentration in the same well was low and indicated a source other than domestic sewage. Approximately 65% of its groundwater contributing area was residential in character with wells located in a mix of residential and institutional land. Contamination of the groundwater in this subsystem was primarily due to seepage from cesspools and septic tanks, but chloride levels also indicated presence of road salt runoff.

There has been no additional groundwater well water quality monitoring since the FANS study with exception of localized monitoring that may have been done by others as environmental remediation efforts for contaminated sites (see **Section 2.3.4**).

<u>Watchogue Creek</u>
The FANS study determined that there were no wells close enough to this creek to have any value in relating quality in the stream with that in the glacial aquifer. However the FANS report for Watchogue Creek indicated that the groundwater quality data averages for the entire study area were probably representative of those concentrations existing in the groundwater sustaining the Creek at that time. Contamination of the groundwater in the study area was primarily due to seepage from cesspools and septic tanks. Chloride levels also indicated presence of road salt runoff.

USGS water quality monitoring has been conducted at two wells (S 20566.1 and S 45446.1) in the upper portion of the sub-area. Station 20566.1 (on the boundary of the Lawrence Creek and Watchogue Creek sub-areas) was sampled from 1972 through 1992 and had nitrate levels below the 0.10 mg/L Minimum Detection Limit (MDL) with exception of a high of 1.22 mg/L in 1973. Phosphorus was also generally less than the 0.10 mg/L MDL, with exception of a high concentration of 0.16 mg/L in 1980. Station 45446.1 had a total of 35 field/lab water quality samples from 1972 through 1985. Nitrate was very high, violating the NYS standard with a value of 15.0 mg/L in 1972 and reaching a maximum concentration of 17.0 mg/L in 1984 but has since begun to decline. Chloride ranged from 38 mg/L in 1972 to a high of 59.5 in 1979, indicating some influence from road salt practices.

<u>Penataquit Creek</u>
Approximately 50% of its groundwater contributing area was residential in character with wells also located in a mix of commercial and institutional land. Contamination of the groundwater in this subsystem was primarily due to seepage from cesspools and septic tanks, but chloride levels also indicated presence of road salt runoff. The mean concentration of chloride, total nitrogen and phosphorus associated with commercial land use were greater than those for the residential categories, suggesting that the commercial lands which account for 14% of the contributing area are significant sources of groundwater contamination. Phosphorus frequently violated USEPA

guidelines, averaging 0.064 mg/L and having a maximum value of 0.380 mg/L. Violations of standards for nitrate, ammonia, dissolved oxygen and chloride were sometimes detected in groundwater wells, and violations of pH were frequently observed.

Since the FANS study, USGS water quality monitoring has been conducted at four wells. In the central part of the drainage area, Station 50546.1 was sampled from 1975 through 1992 and had nitrate levels below the Minimum Detection Limit (< 0.10 mg/L). Phosphorus was higher with a max of 1.72 in 1985. This station is within the Southwest Sewer District. Three wells are clustered together at the northeast corner of the study area and outside of the sewer district (S 16176.1, 18566.1 and 38192.1). Station 16176.1 was sampled between 1959 and 1981; nitrate values escalated from 4.72 in 1966 to a near NYS standard limit of 9.85 mg/L in 1980. Nitrate values were observed much lower in 1981 (3.07 mg/L) but still above average levels. The other two wells had much lower nitrate values through the 1980's, with a high of 1.26 in 1985. Phosphorus in both wells was generally low and < 0.10 mg/L, as was chloride.

Overall, nitrogen and chloride levels appear to have improved and no longer violate NYS standards. Phosphorus also appears to less frequently violate USEPA recommended guidelines, but had a maximum value of 1.72 mg/L in 1985 which was higher than observations conducted before 1980. Dissolved oxygen and pH both continue to appear to routinely violate NYS standards. Some impairment of groundwater quality is evident, but stormwater impairments to Penataquit Creek appear to have greater impacts on this system.

<u>Awixa Creek</u>
Land use within the contributing area is varied with approximately 35% of it being residential in character and 20% being commercial. These lands produce large quantities of nonpoint source pollution. Contamination of the groundwater in this subsystem was primarily due to seepage from cesspools and septic tanks, but elevated chloride levels were also encountered and indicate contamination due to road salt runoff or dewatering during sewer construction. Phosphorus frequently violated USEPA guidelines, averaging 0.057 mg/L and having a maximum value of 0.320 mg/L. Violations of standards for total nitrogen (mean of 6.57 mg/L; maximum of 14.03 mg/L) and dissolved oxygen (mean of 4.7 mg/L) were sometimes detected in groundwater wells. However, ammonia (mean of 3.81 mg/L; maximum of 14.00 mg/L) and pH (mean of 6.3) were observed to frequently violate NYS standards.

There has been no additional groundwater well water quality monitoring since the FANS study with exception of localized monitoring that may have been done by others as environmental remediation efforts for contaminated sites (see **Section 2.3.4**).

<u>Orowoc Creek</u>
Land use within the western branch's contributing area is approximately 60% residential, but wells in this contributing area are also located on institutional, transportation and commercial lands. For those wells on residential land, chloride and phosphorus concentrations were less in Orowoc Creek West than in the entire FANS study area. However, total nitrogen concentrations in this area were higher than in the entire FANS study area, with groundwater found to be more

contaminated than would be expected. In the Orowoc Creek West sub-area, sampled wells had nitrate concentrations which averaged 4.7 mg/L (range of 0.02 to 23 mg/L) and sometimes exceeded the NYS standard in two wells. Nitrite averaged 0.013 mg/L. Ammonia was very high, frequently exceeded the NYS standard and averaging 2.6 mg/L with a maximum concentration of 15 mg/L. Contamination of the groundwater in this subsystem was evident and primarily due to seepage from cesspools and septic tanks, but elevated chloride levels violating the 250 mg/L NYS standard were also encountered (max of 320 mg/L recorded) and indicate contamination due to road salt runoff or dewatering during sewer construction. Among all land use types, phosphorus could be considered elevated, averaging 0.112 mg/L and frequently exceeding the USEPA standard of 0.031 mg/L for streams. Temperature averaged 17.1^{o}C (higher than that desirable for sustaining naturally reproducing trout waters), and ranged from 9.5 to 30^{o}C.

Land use within the eastern branch's contributing area is varied and approximately 65% residential, but wells in this contributing area are also located on forest, vacant and industrial lands. For those wells on residential land, total nitrogen and phosphorus levels were less than all of the wells with the same land use category in the entire FANS study area. However, chloride concentrations in wells on forest and vacant land were higher than would be expected, while the ammonia concentration in the well designated as industrial was much higher than expected. In the Orowoc Creek West sub-area, sampled wells had much lower nitrate concentrations than its western neighbor and averaged 1.38 mg/L (range of 0.02 to 5.60 mg/L). Nitrite averaged 0.005 mg/L. Ammonia, however, was also very high, frequently exceeded the NYS standard and averaging 3.3 mg/L with a maximum concentration of 38.0 mg/L. Contamination of the groundwater in this subsystem from cesspools and septic tanks was highly evident. Chloride was less of a problem, never exceeding the 250 mg/L NYS standard but averaging 39 mg/L with a maximum value of 160 mg/L recorded. Phosphorus could also still be considered elevated, averaging 0.043 mg/L and frequently exceeding the USEPA standard of 0.031 mg/L for streams. Cooler than the western branch, temperature averaged 15.6^{o}C (higher than that desirable for sustaining naturally reproducing trout waters), and ranged from 9 to 24^{o}C. Temperatures of 24^{o}C (75^{o}F) are known to be lethal to trout. Aside from elevated temperatures from stormwater runoff into the creek, groundwater itself has highly elevated temperatures which inhibit this once significant trout stream from any longer supporting sensitive cold-water fish populations.

Since 1980, USGS water quality monitoring has been conducted at two wells clustered between the creek's eastern and western branches. Results show improvement in water quality. Stations 20603.1 and 45839.1 had water quality sampling conducted between 1980 and 1987 and are both within the sewer district. Station 45839.1 had nitrogen concentrations with all samples below the 0.10 mg/L minimum detection limit (MDL). The other well had detectable levels, though all below the NYS standard. Nitrate concentrations steadily increased from 0.37 mg/L in 1980 to much higher values varying between 7.18 and 7.75 mg/L throughout 1982 and though still high, had decreased since the prior decade. Phosphorus in both wells was below the 0.10 mg/L MDL and show that there has been at least a moderate decrease in phosphorus levels since the FANS study. Chloride in both wells had significantly dropped since the FANS study, with no further violations and a maximum value of 24.5 mg/l recorded. Sodium in S 20603.1, however, exceeded the NYS standard on one occasion with a maximum value of 21.0 mg/L. One temperature measurement in S 45839.1 was recorded and found to be 11.8^{o}C in January 1987. Further well monitoring data, including temperature information, should continue to be collected to track improvements or declines in water quality.

Champlin Creek

The maximum concentration of total nitrogen was measured as 73.5 mg/L (primarily in the form of nitrate), which is unusually high and possibly the result of analytical error. Some of the well observations were indicative of being located in close proximity to a source of domestic sewage. Chloride in most of the sampled wells was relatively uniform and not inordinately high, averaging 34.37 mg/L and appearing to be derived from domestic sewage. The highest chloride concentration detected was 130 mg/L, and the two wells with highly elevated chloride were determined to be at least partially derived from road salt runoff since the associated total nitrogen concentrations were not indicative of presence of domestic sewage in the wells. These wells were situated on institutional lands with large areas of surface pavement which may funnel stormwater runoff to the groundwater. The maximum phosphorus concentration (2.0 mg/L) was detected in a well with a highly elevated ammonia concentration (20.0 mg/L), clearly implicating the presence of domestic sewage as the source of phosphorus. Land use within the contributing area is varied with approximately 65% of it being residential. Contamination of the groundwater in this subsystem was primarily due to seepage from cesspools and septic tanks, but elevated chloride levels were also encountered and indicate contamination due to road salt runoff. Temperature averaged 15.9^{o}C (higher than that desirable for sustaining naturally reproducing trout waters), and ranged from 8 to 25^{o}C. For comparison, the maximum allowable temperature for discharges into trout waters of NYS is 21.1^{o}C. Trout growth has been known to stop at 15^{o}C (59^{o}F) and temperatures of 24^{o}C (75^{o}F) are known to be lethal to trout (**Hach, 2006**).

USGS has been conducting water quality monitoring at several wells within the Champlin Creek contributing area. The southern-most well (S 63835.) is situated near Montauk Highway on the west side of the creek and though it is still an active groundwater-level monitoring well, it has only had one water quality sample taken in 2006 but with surprising results. Ammonia was not high (0.023 mg/L) and nitrate was modest at 3.29 mg/L. However, chloride was very high (230 mg/L) and nearly at the NYS standard of 250 mg/L. Sodium was also very high (129 mg/L) and well above the NYS standard of 20 mg/L). Dissolved oxygen in the same well was very low (1.7 mg/L) and it was acidic with a pH of 6.1. Road runoff clearly has a major impact on this well. This shallow well is 11.5 feet below the land surface but had a temperature value of 20.5^{o}C which is higher than what would generally be expected for groundwater.

Northeast of Knapp's Lake, Station 63618.1 is an active USGS groundwater-level monitoring well, but water quality samples were only taken from 1979-1987. These samples revealed low levels of nitrate and chloride. Phosphorus showed a decrease from 0.590 mg/L in 1984 to 0.02 mg/L in 1987. One temperature measurement of 12.6^{o}C was recorded in February 1987.

Just north of Sunrise Highway, Station 63831.1 was sampled from 1984-1985 and revealed relatively low levels of nitrogen with a maximum of 3.0 mg/L and average chloride values. Just below the Southern State Parkway, three wells are clustered together which were sampled through the mid 1980's. All had low levels of nitrate (< 1 mg/L) and very low chloride, but some high phosphorus readings (1.86 mg/L in 1982, 2.38 in 1985). Temperature varies from 12.5 to 15.5^{o}C, with the maximum value of 15.5^{o}C being measured in November 1984. Values of 15.0^{o}C were measured in October 1984 and August 1985.

In the northern part of the watershed, Station 17987.4 is situated near the NY Institute of Technology Campus and the Long Island Ducks Stadium. It is also an active USGS groundwater-level monitoring well but has one water quality sample from August 2006. Nutrient and chloride concentrations were all low, but dissolved oxygen and pH were both found to be below NYS standards. Temperature was recorded to be 15.0^{o}C

The last cluster of three USGS wells occurs in the northwest corner of the drainage area, just outside the sewer district. Two of the wells were only sampled up until 1973 and 1980. However, Station 39531.1 was sampled from 1972 through 1985. Nitrate values were moderate with a maximum of 6.01 mg/L in 1985, but chloride values were low. Phosphorus values were all below MDL (0.01 mg/L).

Champlin Creek was formerly a significant trout stream, but has not been able to support natural trout spawning populations for several years. It was listed as a NYS-impaired water body for thermal impairments and recently de-listed as a NYS significant fish and wildlife habitat. Aside from stormwater discharges that are entering the creek, groundwater which recharges the creek often exceeds 15^{o}C and further hinders Champlin Creek from supporting natural trout populations. On a positive note, nitrogen has not been recorded as violating NYS standards since 1980, and phosphorus levels have also begun to show improvement. Sodium levels also continue to be highly elevated and routinely violate the NYS standard. Though chloride levels have not surpassed the NYS standard, high concentrations in conjunction with astounding sodium values indicate impacts from road salts and/or a road salt storage facility, such as the salt storage facility located at the public maintenance yard near NYIT. Implementation of measures to control road salts from entering surface and ground water is clearly necessary. Aside from elevated chloride and temperatures from stormwater runoff into the creek, the groundwater itself has highly elevated temperatures which inhibit this once significant trout stream from any longer supporting sensitive cold-water fish populations. Further well monitoring data, including temperature information, should continue to be collected to track improvements or declines in water quality.

<u>Quintuck Creek</u>
No groundwater monitoring wells are known to exist in proximity to Quintuck Creek. Collection of monitoring data for this Creek should be highly considered to track improvements or declines in water quality.

Table 2-6: Summary of Groundwater Quality Data

Parameter (Water quality rating as per criteria from **Table 2-2**: ○ - Never exceeds; ◑ - Sometimes exceeds; ● – Routinely exceeds)

Stream		TP (mg/L)	TN (mg/L)	Nitrate (NO_3) (mg/L)	Nitrite (NO_2) (mg/L)	Ammonia (NH_3) (mg/L)	Dissolved Oxygen (mg/L)	pH	Sodium (Na) (mg/L)	Chloride (Cl) (mg/L)	Tempe-rature (°C)	Comments
Criteria/ Guidance		Streams: 0.031	NYS: 10.0	NYS: 10.0	Hach: 0.5 *Hach: 0.06 for Champ. & Orow*	NYS: 2.0	NYS: 4.0; *5.0 for trout in Champ.& Orow*	NYS: 6.5 to 8.5	NYS: 20	NYS: 500	32.2°C nontrout *21.1°C- trout Champ. & Orow*	
Trues Creek	**Pre-1980**	●	◑	○	○	●	◑	◑		○	○	
	Post-1980						●	●			○ <10°C	- USGS sampled 1 well 2x in March 2001 for chemical constituents, but not for nutrients.
Thompsons Creek	**Pre-1980**	◑	○	○	○	○	○	●		○	○	
	Post-1980											- No further data collected.
Lawrence Creek	**Pre-1980**	●	●	●	○	●	○	●		○	○	
	Post-1980											- No further data collected.
Watchogue Creek	**Pre-1980**											- No wells in close proximity for FANS analysis.
	Post-1980		●	●						○		- USGS sampled 2 wells (1972-1992).
***Penataquit Creek**	**Pre-1980**	●	◑	◑	○	◑	◑	●		◑	○	
	Post-1980	◑	○	○	○		●	●	○	○	○ <11°C	- USGS sampled 4 wells (1980-1992). - Groundwater quality better than surface water quality. - Stormwater appears to be primarily impacting the system.
***Awixa Creek**	**Pre-1980**	●	◑	○	○	●	◑	●		○	○	
	Post-1980											- No further data collected.
[T]Orowoc Creek – W	**Pre-1980**	●	◑	◑	◑	●	◑	◑		◑	◑ ≤30°C	- Temperatures are sometimes lethal to trout (24°C) and regularly above levels that are desirable for trout.
	Post-1980		○	○		○		●	◑	○		- USGS sampled 1 well 15x (1980-1982).
[T]Orowoc Creek - E	**Pre-1980**	●	◑	○	○	●	●	●		○	◑ ≤24°C	- Temperatures are sometimes lethal to trout (24°C) and regularly above levels that are desirable for trout.
	Post-1980							●	○	○	○ <12°C	- USGS sampled 1 well 7x (1980-1987), but only one sample had temperature data.
***[T]Champlin Creek**	**Pre-1980**	●	◑	◑	○	◑	●	●		○	◑ ≤25°C	- Temperatures are sometimes lethal to trout (24°C) and regularly above levels that are desirable for trout.
	Post-1980	◑	○	○		○	●	●	●	○	○ <21°C	- USGS sampled 10 wells (1980-2006). - Though below temperatures that are lethal to trout (24°C), temperatures are regularly above levels that are desirable for trout.
Quintuck Creek												- No data ever collected.

[T] Stream formerly supported naturally spawning trout populations; NYSDEC water quality classification indicate trout waters as a designated use, but Champlin and Orowoc have not been capable of supporting this designated use in recent decades.
* Indicates stream is included on NYSDEC 303(d) List of Impaired Waters.

2.3 Natural Resources

Natural resources within the Great Cove watershed include upland as well as freshwater and tidal wetland habitats, other aquatic resources and special resource management areas. Each of these is further examined below.

2.3.1 Upland, Freshwater, & Tidal Wetland Habitats

Both freshwater and tidal wetlands areas exist within the watershed, and are illustrated in **Figure 2-5**. Twenty-three (23) NYSDEC regulated freshwater wetlands are identified within the watershed, and comprise ±730 acres (4.3%) of the watershed. NYSDEC classifies freshwater wetlands into four categories, which are described in §664.5 of the NYSDEC regulations. Class I wetlands are considered the most pristine and therefore the most valuable, while Class IV wetlands lack characteristics which would give the wetland a high value. The definitions of each class category, as provided by the NYSDEC, are listed below.

Class I wetlands:
A wetland shall be a Class I wetland if it has any of the following seven enumerated characteristics:

Ecological associations
(1) it is a classic kettlehole bog
Special features
(2) it is resident habitat of an endangered or threatened animal species
(3) it contains an endangered or threatened plant species
(4) it supports an animal species in abundance or diversity unusual for the state or for the major region of the state in which it is found
Hydrological and pollution control features
(5) it is tributary to a body of water which could subject a substantially developed area to significant damage from flooding or from additional flooding should the wetland be modified, filled, or drained
(6) it is adjacent or contiguous to a reservoir or other body of water that is used primarily for public water supply, or it is hydraulically connected to an aquifer which is used for public water supply or
Other
(7) it contains four or more of the enumerated Class II characteristics. The department may, however, determine that some of the characteristics are duplicative of each other, therefore do not indicate enhanced benefits, and so do not warrant Class I classification.

Class II wetlands:
A wetland shall be a Class II wetland if it has any of the following seventeen enumerated characteristics:

Covertype
(1) it is an emergent marsh in which purple loosestrife and/or reed (*Phragmites*) constitutes less than two-thirds of the covertype
Ecological association
(2) it contains two or more wetland structural groups
(3) it is contiguous to a tidal wetland

(4) it is associated with permanent open water outside the wetland
(5) it is adjacent or contiguous to streams classified C(t) or higher under article 15 of the environmental conservation law

Special features

(6) it is traditional migration habitat of an endangered or threatened animal species
(7) it is resident habitat of an animal species vulnerable in the state
(8) it contains a plant species vulnerable in the state
(9) it supports an animal species in abundance or diversity unusual for the county in which it is found
(10) it has demonstrable archaeological or paleontological significance as a wetland
(11) it contains, is part of, owes its existence to, or is ecologically associated with, an unusual geological feature which is an excellent representation of its type

Hydrological and pollution control features

(12) it is tributary to a body of water which could subject a lightly developed area, an area used for growing crops for harvest, or an area planned for development by a local planning authority, to significant damage from flooding or from additional flooding should the wetland be modified, filled, or drained
(13) it is hydraulically connected to an aquifer which has been identified by a government agency as a potentially useful water supply
(14) it acts in a tertiary treatment capacity for a sewage disposal system

Distribution and location

(15) it is within an urbanized area
(16) it is one of the three largest wetlands within a city, town, or New York City borough or
(17) it is within a publicly owned recreation area

Class III wetlands:

A wetland shall be a Class III wetland if it has any of the following fifteen enumerated characteristics:

Covertypes

(1) it is an emergent marsh in which purple loosestrife and/or reed (Phragmites) constitutes two-thirds or more of the covertype
(2) it is a deciduous swamp
(3) it is a shrub swamp
(4) it consists of floating and/or submergent vegetation
(5) it consists of wetland open water

Ecological associations

(6) it contains an island with an area or height above the wetland adequate to provide one or more of the benefits described in section

Special features

(7) it has a total alkalinity of at least 50 parts per million
(8) it is adjacent to fertile upland
(9) it is resident habitat of an animal species vulnerable in the major region of the state in which it is found, or it is traditional migration habitat of an animal species vulnerable in the state or in the major region of the state in which it is found
(10) it contains a plant species vulnerable in the major region of the state in which it is found

Hydrological and pollution control features

(11) it is part of a surface water system with permanent open water and it receives significant pollution of a type amenable to amelioration by wetlands

Distribution and location

(12) it is visible from an interstate highway, a parkway, a designated scenic highway, or a passenger railroad and serves a valuable aesthetic or open space function

(13) it is one of the three largest wetlands of the same covertype within a town

(14) it is in a town in which wetland acreage is less than one percent of the total acreage or

(15) it is on publicly owned land that is open to the public

Class IV wetlands:

A wetland shall be a Class IV wetland if it does not have any of the characteristics listed as criteria for Class I, II or III wetlands. Class IV wetlands will include wet meadows and coniferous swamps which lack other characteristics justifying a higher classification.

Table 2-7 lists the NYSDEC freshwater wetlands located within the overall watershed boundary, the smaller creek and canal watersheds which the wetlands are located within, the water quality classifications of the wetlands, and the approximate size of the wetlands (as indicated by the NYSDEC).

TABLE 2-7
NYSDEC Freshwater Wetlands within the Great Cove Watershed

NYSDEC Freshwater Wetland ID Number	Individual Creek Watersheds	Classification	Size (±Acres)
BW-7	Trues Creek, Thompson Creek, Hyde Canal	1	160.1
BW-16	Trues Creek	2	3.0
BW-18	Hyde Canal	1	6.3
BW-17	Southward CC Canal	2	2.1
BW-19	Southward CC Canal	2	0.8
BW-20	Southward CC Canal, Brightwaters Canal	2	37.6
BW-6	Brightwaters Canal	2	16.7
BW-3	Lawrence Creek	2	4.1
BW-21	Lawrence Creek	2	6.8
BE-1	Penataquit Creek	1	46.1
BE-2	Awixa Creek	2	25.9
BE-3	Orowoc Creek	1	99.4
BE-4	Orowoc Creek	1	64.7
BE-30	Orowoc Creek	2	6.5
BE-11	Orowoc Creek, Champlin Creek	1	59.4
BE-5	Champlin Creek	1	126.5
BE-31	Champlin Creek	1	12.7
BE-12	The Moor, Quintuck Creek	1	65.4
BE-33	The Moor	2	2.1
BE-23	The Moor	2	8.8
BE-24	The Moor	2	3

BE-32	Quintuck Creek	2	1.7
BE-13	Quintuck Creek, Heckscher Park*	1	130.4

*Note: The Heckscher Park watershed is outside of the Great Cove study area.

As illustrated in the above table, freshwater wetlands located within the Great Cove watershed are generally of higher value, as all wetlands are Class I or II. The largest freshwater wetland system occurs in the westernmost portion of the watershed, and the second largest occurs in the easternmost portion of the watershed. It should be noted that the Watchogue Creek watershed does not contain any NYSDEC regulated freshwater wetlands.

The NYSDEC classifies tidal wetlands into fourteen distinct categories. Definitions for those categories present within the Great Cove Watershed are provided below.

SM - Coastal Shoals, Bars and Mudflats: The tidal wetland zone that at high tide is covered by saline or fresh tidal waters, at low tide is exposed or is covered by water to a maximum depth of approximately one foot, and is not vegetated.

LZ - Littoral Zone: The tidal wetland zone that includes all lands under tidal waters which are not included in any other category. There shall be no LZ under waters deeper than six feet at mean low water.

FC - Formerly Connected: The tidal wetlands zone in which normal tidal flow is restricted by man-made causes. *Phragmites sp.* is the dominant vegetation.

IM - Intertidal Marsh: The vegetated tidal wetland zone lying generally between average high and low tidal elevation in saline waters. The predominant vegetation in this zone is low marsh cord grass, *Spartina alterniflora.*

HM - High Marsh: The normal upper most tidal wetland zone usually dominated by salt meadow grass, *Spartina patens*; and spike grass, *Distichlis spicata*. This zone is periodically flooded by spring and storm tides and is often vegetated by low vigor, *Spartina alterniflora* and Seaside lavender, *Limonium carolinianum.* Upper limits of this zone often include black grass, *Juncus gerardi*; chairmaker's rush, *Scirpus sp.*; marsh elder, *Iva frutescens*; and groundsel bush, *Baccharis halimifolia*.

DS - Dredged Spoil All areas of fill material.

Table 2-8 provides the tidal wetlands present within each individual watershed. Watersheds are listed in order from west to east, and tidal wetlands habitats are listed by area occupied within the watershed, from greatest to least.

TABLE 2-8
Tidal Wetlands within Individual Creek & Canal Watersheds

Creek/Canal Watershed	NYSDEC Tidal Wetlands Present
Trues Creek	HM, LZ, IM, DS, SM
Thompson Creek	HM, LZ, IM
Hyde Canal	HM, LZ, FC
Southward CC Canal	HM, FC, DS, LZ
Brightwaters Canal	LZ
Lawrence Creek	LZ, IM
Watchogue Creek	LZ
Penataquit Creek	LZ
Awixa Creek	LZ
Orowoc Creek	LZ, HM, FC, DS
Champlin Creek	LZ, DS, HM
The Moor	LZ
Quintuck Creek	LZ, HM, DS, IM

Most of the vegetated tidal wetland areas occur within the easternmost and westernmost areas of the Great Cove watershed. This is generally a result of the development and hardened shorelines which exist along the creeks and canals located within the central portion of the watershed. Littoral Zone (LZ) wetlands extend the farthest north (Orowoc Creek), and end just below S.R. 27A (Montauk Highway). More specifically, Brightwaters Canal, Lawrence Creek, Watchogue Creek, Penataquit Creek, Awixa Creek and The Moor Watersheds are highly developed and contain large areas of bulkheading along the shorelines which prevent areas of vegetated tidal wetlands beyond the littoral zone from establishing. In contrast, the remaining watersheds contain large areas of vacant land along the shoreline, providing more area for vegetated tidal wetlands to establish landward. These areas are predominantly occupied by publicly owned parks (active and passive) which prevent further development and shoreline hardening within the watershed. Trues Creek, Thompson Creek and Hyde Canal watersheds contain county and state parkland (Gardiner's County Park and HJ Isbrandtsen State Tidal Wetlands), while the Southward CC Canal contains privately owned vacant land along the shoreline. Both the Orowoc Creek and Champlin Creek watersheds contain the Seatuck National Wildlife Refuge which is a large park located along the shoreline. The Town of Islip also owns a large tract of vacant land adjacent to the west of the wildlife refuge providing further wetland areas. The Quintuck Creek watershed contains the greatest area of vegetated tidal wetlands, as three parks exist within this watershed (Islip Meadows County Nature Preserve, East Islip Marina Park, and Heckscher State Park). It should be noted that the creeks with the hardened shorelines may contain small areas of vegetated tidal wetlands, but that the creeks identified above contain the largest tracts of tidal wetlands which provide the majority of the resources associated with the tidal wetland habitat.

2.3.2 Upland and Aquatic Resources

Upland and aquatic resources within the Great Cove Watershed include a variety of upland woodland and grassland habitats as well as tidal and freshwater wetlands which provide habitat for wildlife, as well as provide abundant recreational and commercial opportunities such as hiking, swimming, fishing, shellfishing and boating. Certain areas provide more significant habitat opportunities than others, either due to their location, complexity, water quality or other factors.

The New York Natural Heritage program was contacted to determine the presence of significant ecological communities within the watershed area, and to identify the presence of rare, threatened or endangered species potentially located from the watershed. A response from the program was received on May 24, 2010 which identified the presence of five significant natural communities, five rare species, fourteen threatened species and eleven endangered species located within or within the vicinity of the Great Cove watershed. Thirteen records of the historical presence of rare, threatened and endangered species was identified as well. Most of the species and communities identified are located within the eastern portion of the watershed and near the shoreline. **Table 2-9** below provides a summary of the species identified by habitat type, and identification of which species are located within the watershed. **Figure 2-6** illustrates areas within the watershed that contain significant habitats where rare, threatened, endangered or special concern species occur.

Table 2-9
RARE SPECIES IDENTIFIED BY THE NYNHP

Habitat Type		**NYS Legal Status (Endangered, Threatened, Rare, Special Concern)**	**Located Within Watershed Boundary?**
PINE-OAK FOREST		--	--
Species Common Name	**Species Scientific Name**	--	--
Red-banded Hairstreak	*Calycopis cecrops*	Unlisted	Yes
Edwards' Hairstreak	*Satyrium edwardsii*	Unlisted	No
Coastal Barrens Buckmoth	*Hemileuca maia ssp. 5*	Special Concern	No
St. Andrew's Cross	*Hypericum hypericoides ssp. Multicaule*	Endangered	No
SUCCESSIONAL FIELD/GRASSLAND/CLEARING		--	--
Species Common Name	**Species Scientific Name**	--	--
Stargrass	*Aletris farinosa*	Threatened	Yes
Showy Aster	*Eurybia spectabilis*	Endangered	Yes
Shrubby St. John's-wort	*Hypericum prolificum*	Threatened	Yes
Slender Pinweed	*Lechea tenuifolia*	Threatened	No

Narrow-leaved Bush-clover	*Lespedeza angustifolia*	Rare	No
Northern Blazing-star	*Liatris scariosa var. novae-angliae*	Threatened	Yes
Southern Yellow Flax	*Linum medium var. texanum*	Threatened	No
Whip Nutrush	*Scleria triglomerata*	Threatened	Yes
FRESHWATER WETLAND/BOG/SWAMP		--	--
Species Common Name	**Species Scientific Name**	--	--
Slender Blue Flag	*Iris prismatica*	Threatened	No
Large Grass-leaved Rush	*Juncus biflorus*	Endangered	Yes
Scirpus-like Rush	*Juncus scirpoides*	Endangered	Yes
Field Beadgrass	*Paspalum leave*	Endangered	No
Orange Milkwort	*Polygala lutea*	Endangered	Yes
Comb-leaved Mermaid-weed	*Proserpinaca pectinata*	Threatened	Yes
Flowering Pixiemoss	*Pyxidanthera barbulata*	Endangered	Yes
Small Floating Bladderwort	*Utricularia radiata*	Threatened	Yes
Primrose-leaf Violet	*Viola primulifolia*	Threatened	Yes
TIDAL WETLANDS/SALT MARSH		--	--
Species Common Name	**Species Scientific Name**	--	--
Marsh Straw Sedge	*Carex hormathodes*	Threatened	Yes
Yellow Flatsedge	*Cyperus flavescens*	Endangered	No
Creeping Spikerush	*Eleocharis fallax*	Endangered	Yes
Slender Spikerush	*Eleocharis tenuis var. pseudoptera*	Endangered	Yes
Swamp Sunflower	*Helianthus angustifolius*	Threatened	Yes
Slender Marsh-pink	*Sabatia campanulata*	Endangered	Yes
Coastal Goldenrod	*Solidago latissimifolia*	Endangered	Yes

As depicted in the table above, several habitat types potentially contain species which are identified as special concern, threatened or endangered. Both the species and habitat types will be considered when providing stormwater improvement recommendations provided in **Section 4.2** to ensure that no plants which are listed as special concern, threatened or endangered will be negatively impacted by any stormwater improvements recommended.

<u>Anadromous Fish</u>
The historic extent of anadromous fish use in tributaries of Long Island's South Shore Estuary Reserve was digitally compiled by the U.S. Fish and Wildlife Service based on information obtained from a NYSDEC 1938 biological survey. Historic anadromous fish runs were identified in two streams within the watershed and are illustrated as the "Historic Anadromous Fish Run" layer in **Figures 2-6**. Both Orowoc Creek and Champlin Creek have been known to be utilized by salmonids (e.g. salmon, trout). Historic use of Orowoc Creek by salmonids extended up to Montauk Highway on both branches of the creek, while use of Champlin Creek was previously recorded as occurring up to approximately 500 feet below Montauk Highway.

Seatuck Environmental Association in conjunction with the SSER currently conducts alewife spawning volunteer monitoring surveys in Long Island each spring. These surveys began in 2006 to document existing spawning runs and to guide habitat protection and restoration projects. The survey has since documented populations of alewives remaining in a number of tributaries around Long Island. In 2006, Quantuck Creek was monitored for alewife, but no observations were reported (**Kritzer, et. al., 2007**). In 2008 and 2010, there was some limited volunteer observer effort within Champlin Creek although no alewives were sighted. However, anecdotal evidence suggests alewives have been in the creek in recent years (**Hughes & O'Reilly, 2008**). In 2009, Penataquit Creek was also monitored with no confirmed sightings, although one fisherman reported seeing alewives in both Penataquit and Orowoc Creek in past years, suggesting there may be remnant alewife runs (**Kelder, 2009**). Kelder also noted that a 2008 New York Department of Transportation project at Penataquit Creek improved fish passage potential through culvert renovation and addition of a step-pool system at the head of tide. Orowoc Dam presents a migration barrier near the head of tide, limiting opportunity for upstream migration. None of the other study area tributaries have had any recent alewife monitoring. Despite limited anecdotal information, there is currently no documented occurrence of alewife runs within the tributaries of Great Cove. However, alewife are known to be spawning within the nearby Connetquott and Carll's Rivers, and therefore it is likely that some alewife are present within Great Cove (**Kelder, 2010**).

2.3.3 Special Resource Management Areas

<u>Significant Coastal Fish and Wildlife Habitats</u>

Special resource management areas within the Great Cove watershed include one (1) State designated Significant Coastal Fish and Wildlife Habitat (SCFWH) (Great South Bay- West) and the Great South Bay waterfowl focus area (see **Figure 2-6**). The SCFWH designated within Great Cove includes marsh areas between Trues Creek and Thompsons Creek, marsh areas within the Islip Meadows County Nature Preserve, and most of Quintuck Creek. These areas are designated due to the presence of rare, threatened or endangered species and populations of waterfowl which use the area, the rarity of the ecosystem, the availability of sport fishing, and the irreplacibility of the ecosystem. The habitat narrative which describes the reasoning behind the SCFWH designation for Great South Bay- West is provided in **Appendix B**.

As discussed in the habitat narrative, the Great South Bay West area was designated a SCFWH for the following reasons:

- Great South Bay West is one of the largest shallow coastal wetland ecosystems in New York State;
- Bird species which are identified as endangered, threatened and species of special concern, including: Roseate tern, common tern, northern harrier, osprey, black skimmer and black rails nest within the area;
- Sport fishing of statewide significance, waterfowl hunting of regional significance and shellfish hatcheries of local significance are present within the area;
- The area supports a large concentration of wintering waterfowl, nesting northern harriers, estuarine fish, and the only population of black rails in New York State;
- The Great South Bay West habitat is considered irreplaceable.

Until 2008, Orowoc Creek and Champlin Creek were also both listed as Significant Fish and Wild Habitats. The upper portion of Orowoc Creek had at one time provided 2.5 miles of habitat above Montauk Highway which was suitable for natural reproduction by brook trout. Similarly, the upper portion of Champlin Creek was previously known to be a relatively clean, cold, freshwater stream with a recreational salmonid fishery of county-level significance and a naturally reproducing brook trout population. However, increased development adjacent to these creeks has led to drying up of the headwaters and led to increasing storm water inputs. Due to water quality impairments, these two creeks no longer provide suitable conditions for or are known to support populations of brook trout for which they were originally designated. Repeal letters for these two creeks are included in **Appendix B**.

Extensive water quality testing has not been done on these two creeks since the late 1990’s and it is not possible to definitively state whether or not water quality has continued to improve or decline in the past twelve years. However, based upon available data from the 1980 FANS study and data collected by the USGS and SCDHS through the 1980’s and 1990’s (see **Section 2.2.1.6**), some trends could be determined. Orowoc Creek’s west branch has shown improved dissolved oxygen levels, though the Creek’s east branch appears to have more frequent problems with low oxygen; both branches continue to have problems with toxic ammonia, high levels of bacteria, and also sometimes exhibit water temperatures that are too warm to sustain healthy trout populations. Champlin Creek still struggles with high nutrients and occasional low levels of dissolved oxygen and high levels of ammonia, but has shown improved water temperatures through 1996 that are better capable of supporting trout.

<u>Long Island South Shore Complex Waterfowl Focus Area</u>

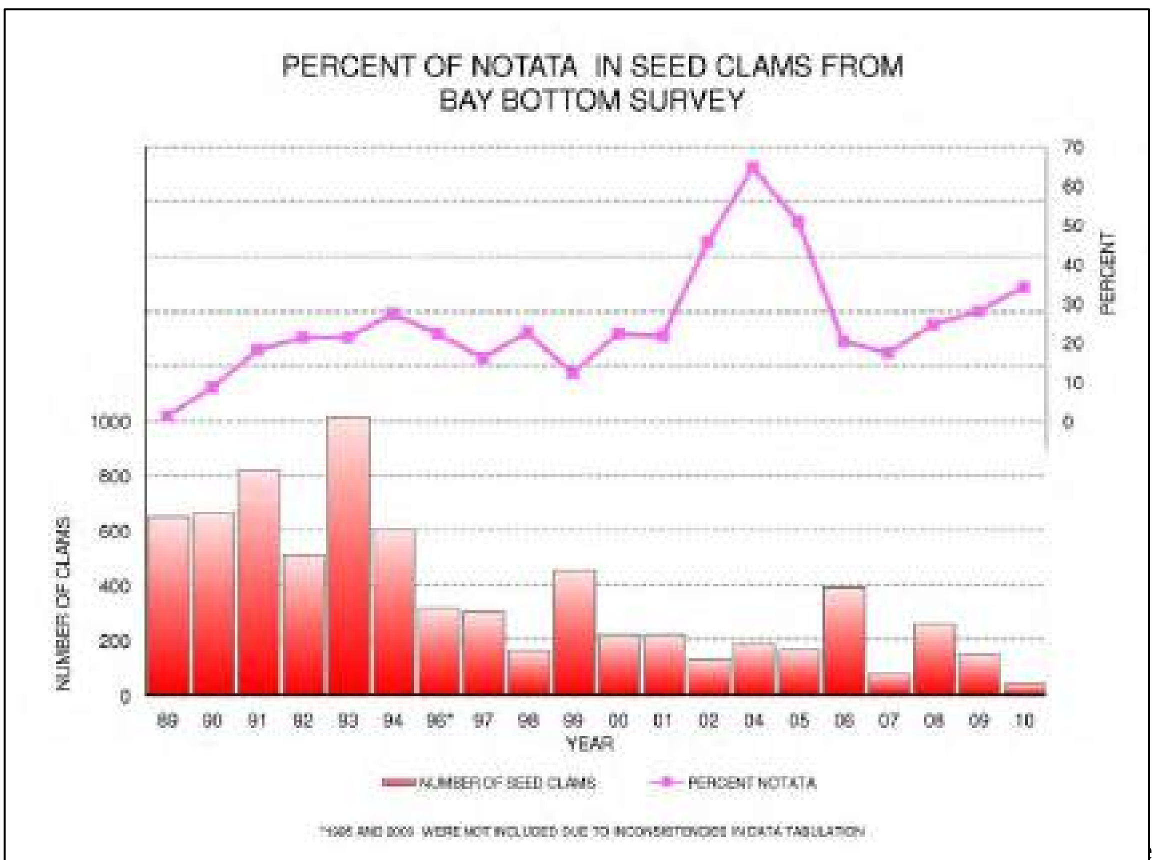
The bay area, an area which includes the marshes between Trues Creek and Thompsons Creek, the open tidal portions of Lawrence Creek, Watchogue Creek, Penataquit Creek, Awixa Creek, Orowoc Creek, Champlin Creek, and Quintuck Creek are identified as the Long Island South Shore Complex waterfowl focus area. The waterfowl focus area is defined by the Atlantic Coastal Joint Venture (ACJV) which focuses on habitat conservation for native avian species. Although no specific recommendations are made for the Long Island South Shore Complex, the ACJV seeks to provide quality waterfowl habitat wherever feasible.

<u>Seatuck National Wildlife Refuge</u>

The Seatuck National Wildlife Refuge is a 196-acre preserve bordering the Great South Bay and situated along the western bank of Champlin Creek at 500 St. Marks Lane, Islip. It was established in 1968 as a land gift from the Peters Webster Family and is managed as part of the Long Island National Wildlife Refuge Complex. Approximately one half of the refuge is comprised of tidal marsh and is an important year-round waterfowl area. Management activities include forest and grassland protection and management, wetland and habitat restoration, wildlife nesting structure maintenance.

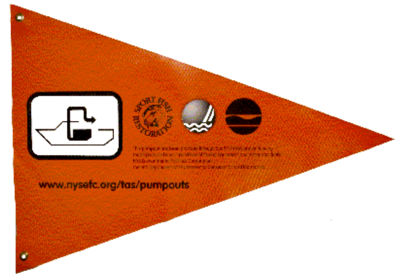
<u>Town of Islip Shellfish Culture Facility</u>
The Town has been conducting bay bottom surveys at 350 stations along Islip's coastline since the late 1970's, to monitor the numbers and types of shellfish growing in its waters. One conclusion was quickly drawn; the hard clam population on its own could not keep up with the demand of commercial and recreational harvesters. In 1988, the Town established a large-scale municipally operated shellfish hatchery and nursery culture facility at the foot of Bayview Avenue in East Islip. The goal was to provide a sustainable source of seed clams to stabilize the clam stocks and rebuild the public resource in Great South Bay. The facility can currently produce up to 40 million seed clams and several million seed oysters for annual planting. The seed is planted throughout Islip's coastal waters and some of it is sold commercially to other municipalities and private growers.

To track their efforts, the hatchery exclusively grows a particular strain of the native hard clam (*Mercenaria mercenaria*), known as *M. mercenaria notata.* The notata variety occurs naturally in very low numbers wherever hard clams are found, but their distinguishing feature which makes them valuable in tracking efforts is that their shells bear distinct wavy or zigzag chestnut-colored lines running across the shell. By breeding these specialized versions of clams, the hatchery has shown evidence of its positive impact on the Bay's clam populations. As compared to survey data from the 1980's when less than one percent of clams collected were *M. mercenaria notata*, data from the 1990's through last year consistently show 20 to 30 percent of the clams recovered are now of the *M. mercenaria notata* variety (see chart below). Without the hatchery, there may be 20 to 30 percent fewer clams in Islip's waters.



Vessel No Discharge Zone

In November 2009, the USEPA approved New York State's petition to designate the embayments in the entire Long Island South Shore Estuary Reserve (SSER) a Vessel No Discharge Zone (NDZ). The NDZ designation prohibits the discharge of any wastes from marine sanitation devices into SSER waters and will encourage boaters to utilize land based and/or mobile vessel pump-out facilities. The New York State Environmental Facilities Corporation (EFC) website (www.nysefc.org) provides maps in Google format of the locations of pumpout locations that have been funded by the Clean Vessel Assistance Program. As of May 2010, there were four pumpout locations within or in the immediate vicinity of the study area: Bay Shore Marina, South Shore Boat, East Islip Marina, and Heckscher State Park. Boaters can look for the large, orange flag which identifies a pumpout facility. Information for each of these pump-out locations is provided in **Appendix A**.



2.3.4 Known Issues and Impairments

2.3.4.1 Marine Resource Management Issues

Impairments in the survival and success of estuarine species of the Great South Bay

The data that is available from agencies that monitor surface and groundwater quality in the study area indicate that the current conditions deviate substantially from natural, background conditions. Streams and groundwater which ultimately empty into Great South Bay continue to show impacts from pollution. Elevated levels of ammonia, nitrogen and phosphorus are common. Volatile organic compounds (VOCs), heavy metals and hydrocarbons are sometimes encountered. Chloride and sodium levels in freshwater streams have significantly increased over the past several decades due to road salting, and are particularly high near salt storage facilities on Penataquit Creek. Stream corridors have been altered by increased development, filling of freshwater wetlands and dumping of solid waste, litter and unwanted debris. The amount of water in the creeks has been reduced because of sewering, and velocity of water in the creeks has been further reduced due to impoundments that also act as barriers to historic diadromous fish spawning runs. As a result of excess nutrients, reduced flows (which limit oxygenation of the water) and warmer temperatures in impounded waterbodies, dissolved oxygen within the creeks has also suffered and sometimes violates critical standards for aquatic life.

These parameters of water quality are akin to the battery of tests that are given to a patient to assess their health. The current diagnosis of the Great Cove Watershed Management Area is that it is seriously ill and in need of intensive care. The symptoms of this condition are not only observed in the freshwater components of the system, but are also evident in the estuarine waters of Great South Bay. Bacteria levels in tidal waters often exceed established NYS Department of Health standards, resulting in closed shellfish beds and public swimming areas. Elevated bacteria levels are indicators of pathogenic viruses that might be present and could lead to illness in humans if contaminated water or shellfish that filter these pathogens are consumed.

Shellfish populations have significantly declined from the abundance that was present in the last century. The historical records shows there were once vast mounds of shells (middens) deposited by Native Americans. More recently, record catches were recorded in the exploits of the Oyster King, Jacob Ockers. Great South Bay was once known as the "clam factory," with the local fishery supplying more than 50 percent of the national annual catch. However, the fishery was not sustainable and harvests have been reduced to just one percent of the peak level seen in the 1970's. With declining hard clam populations, other changes also became apparent. With so many fewer clams filtering the bay's waters, harmful brown tides caused by microscopic algal blooms began to increase, killing additional shellfish and reducing light availability to underwater grasses that harbored young fish, crabs and other organisms. Scallops were once harvested commercially, but were decimated by the brown tides and have not re-appeared in Islip's waters in the past two years. Razor clams, oysters and horseshoe crabs are also in jeopardy. Quotas have been imposed by State agencies to manage the fisheries and address the reduced populations of fin and shellfish, but these too need to be managed carefully and with the best data possible.

Despite the successful work of entities such as the Islip shellfish hatchery, Great South Bay is still in critical health. Its fish and shellfish populations are still at record lows while pollution impacts and fishing pressure are still high. Good water quality is a vital component to a thriving shellfish population and safe harvesting of clams and oysters for consumption. But with less food available, the impact of marine predators (though depleted themselves) on seed clams is proving to be the Islip hatchery's primary challenge.

A multitude of predatory marine organisms enjoy hard clams as meals, sometimes only indulging on the siphon but which is still lethal to the clam. A variety of crabs (blue, mud, calico, rock, spider, hermit, and horseshoe), snapping shrimp, seagulls, whelks, oyster drills, moon snails, starfish and jellyfish have all contributed to decimated clam populations. However, blue crabs in particular are particularly voracious and decimating shellfish populations as well as other crabs. One reason for this imbalance is that blue crabs are protected themselves. A permit from the NYSDEC is needed to harvest blue crabs commercially and size limits are strictly enforced. While it appears as though blue crab regulations are in need of loosening so that the predator population can become more balanced, there are hurdles to the regulatory process. The first hurdle is that the fishery is being managed on inaccurate data – it is imperative that more accurate reporting of catch quantity and size from commercial and recreational fishermen be given to the NYSDEC. The second hurdle is a re-evaluation of how permits are issued. Currently, only a certain number of permits are able to be issued each year and most of the permits are automatically re-issued to prior permit holders even though the permits may not be being utilized (i.e. no blue crabs are being caught). As a result, new candidates who want to catch blue crabs are not able to obtain permits. One suggestion proposed by Martin Byrnes, Assistant Waterways Management Supervisor for the Town of Islip, is that if a licensee does not use their permit for a few years, then the permit should be forfeited.

<u>*Shellfish Closure Areas*</u>

Shellfish Closure Areas are defined by 6 NYCRR Part 41 and regulated by the New York State Department of Environmental Conservation (NYSDEC). **Figure 2-7** provides the general boundaries of the closed shellfish areas within the Town of Islip. Currently, all shellfish beds within the streams, canals, and bay area are closed year round for shellfish harvesting. These closures are a result of poor water quality within the streams, canals and bay area, which make the shellfish present unsafe for human consumption. Shellfish harvesting areas are monitored and regulated by the NYSDEC Bureau of Marine Resources. In addition to permanently closed areas, the NYSDEC monitors Conditional Shellfish areas, which are open to shellfish harvesting at certain times of the year dependent upon water quality (which is directly dependent upon the volume of rainfall or snow melts, i.e. stormwater runoff).

2.3.4.2 Priority Waterbodies List (PWL) and Other Impaired Waterbodies

The Federal Clean Water Act requires states to periodically assess and report on the quality of waters in their state. Section 303(d) of the Act also requires states to identify *impaired waters*, where designated uses are not fully supported. For these impaired waters/pollutants, states must consider the development of a *Total Maximum Daily Load (TMDL)* or other strategy to reduce the input of the specific pollutant(s) restricting water body uses, in order to restore and protect such uses. The water body/pollutant listings in the Section 303(d) List are segmented into a number of categories. The various categories, or Parts, of the list include:

- Part 1 - Individual Waterbodies with Impairment Requiring a TMDL
- Part 2 - Multiple Segment/Categorical Impaired Waterbodies - Includes (a) Acid Rain Waters, (b) Fish Consumption Waters, and (c) Shellfishing Waters
- Part 3 - Waterbodies for which TMDL Development May Be Deferred - Includes (a) Waters Requiring Verification of Impairment, (b) Waters Requiring Verification of Cause/Pollutant, and (c) Waters Where Implementation/Evaluation of Other Restoration Measures is Pending

The *Final NYS 2010 Section 303(d) List* was approved by USEPA on June 29, 2010. **Table 2-10** identifies those water bodies within the study area (except for Category 4c – Great South Bay, Middle) which are included on that list. Champlin, Awixa and Penataquit Creeks are the only tributaries currently included on the 303(d) list. Champlin Creek was first added to the priority water bodies list in 2002 for thermal changes which result from urban/storm runoff. Thermal changes can have significant negative impacts on wild trout populations, which are known to occur in this tributary. Awixa and Penataquit Creek were newly added to the priority water bodies list in 2010 for unknown toxicity pollutants which result from urban/storm runoff. These two tributaries require further verification of which pollutant(s) are causing impairment. Great Cove and the adjacent middle portion of Great South Bay are both 303(d)-listed priority estuarine water bodies. Great Cove has been included on the list since 2002 for pathogens from runoff. Great South Bay is a new addition this year with onsite urban wastewater treatment systems identified as the source of nitrogen which is suspected to be causing the impairment.

Table 2-10
NYSDEC 303(d) List and Other Impaired Waterbodies

Part/ Category	Waterbody Inventory #	Waterbody Name	WI/PWL #	TYPE	CLASS	POLLUTANT	SOURCE	YEAR
1	(MW7.8) AO-GSB-194	Champlin Creek, Upper, and tribs	1701-0019	River	C(TS)	Thermal Changes	Urban/Storm Runoff	2002
2c	(MW7.8) AO-GSB (portion 7)	Great Cove	1701-0376	Estuary	SA	Pathogens	Urban/Storm Runoff	2002
3b	(MW7.3) AO-GSB (portion 2)	Great South Bay, Middle	1701-0040	Estuary	SA	Nitrogen	Onsite WTS, Urban	2010
3b	(MW7.8) AO-GSB-197	Awixa Creek, Upper, and tribs	1701-0093	River	C	Unknown Toxicity	Urb/Storm Runoff	2010
3b	(MW7.8) AO-GSB-198	Penataquit Creek, Upper, and tribs	1701-0092	River	C	Unknown Toxicity	Urb/Storm Runoff	2010
4c	(MW7.3) AO-GSB (portion 2)	Great South Bay, Middle	1701-0040	Estuary	SA	Algal/Weed Growth	Hab/Hyd Mod	-

Not all impaired waters of the state are included on the Section 303(d) List. By definition, the List is limited to impaired waters that require development of a Total Maximum Daily Load (TMDL). A list of *Other Impaired Waterbody Segments Not Listed (on 303(d) List) Because Development of a TMDL is Not Necessary* is also available and was reviewed. The purpose of this supplemental list is to provide a more comprehensive inventory of waters that do not fully support designated uses and that are considered to be impaired. There are three (3) categories of justification for not including an impaired water body on the Section 303(d) List:

- Category 4a Waters - TMDL development is not necessary because a TMDL has already been established for the segment/pollutant.
- Category 4b Waters - A TMDL is not necessary because other required control measures are expected to result in restoration in a reasonable period of time.
- Category 4c Waters - A TMDL is not appropriate because the impairment is the result of pollution, rather than a pollutant that can be allocated through a TMDL.

Only Great South Bay, Middle was listed as a Category 4c water body which suffers from excess algal/weed growth (see **Table 2-10**). This excess aquatic plant growth is identified as resulting from habitat and hydrologic modifications, but because the excess growth is not a pollutant itself but moreover a result of physical factors, it cannot be allocated through a TMDL.

2.3.4.3 Environmental Remediation Sites

There are six (6) environmental remediation sites that are known to occur within the overall surface watershed or within the groundwater contributing area (see **Figure 2-7**). Remediation at three of the six sites has been completed, as per the NYSDEC Environmental Site Remediation Database (**NYSDEC, 2010**) and is summarized below in **Table 2-11**. The remaining three are well into the remediation process.

The K-Bayshore Manufactured Gas Plant (MGP) is a 10-acre superfund site comprised of several parcels located in Bay Shore and Brightwaters on the north side of Union Boulevard and which are bisected by Clinton Avenue. The Bay Shore MGP began operations in the late 1880's and was operated by Mutual Gas and Light Company, The Suffolk Gas and Electric Light Company, and later the Long Island Lighting Company (LILCO) which operated the plant from 1918 until approximately 1973 when most of the facilities were demolished. KeySpan acquired the former MGP in 1998 and entered into an Order on Consent with the NYSDEC to conduct a remedial investigation and remediation of the site in 1999. National Grid acquired KeySpan in 2007 and is the present owner of the former MGP. A remedial action plan for the MGP's main site (first remedial operation unit) was finalized in August 2005 and implementation began in 2007. Remediation is on-going. Installation of oxygen injection to enhance bioremediation at the second operation unit (representing the dissolved phase groundwater plume emanating from the main site which discharges into Lawrence Creek) is also ongoing and monitoring data show the injection systems to be highly effective. Additional actions to address contamination trapped under the rail road within the West Parcel and Brightwaters Yard (third operation unit) are being evaluated. Lastly, in situ treatment of the off-site cesspool area in vicinity of the headwaters of Watchogue Creek (fourth operation unit) occurred at the end of 2009 and results are pending. The Site Health Assessment finds that people are unlikely to come in contact with site-related soil contamination since the site is covered with clean soil, buildings or asphalt. Public water serves the area and there are no known users of the contaminated groundwater. Furthermore, despite groundwater contamination in the vicinity of the site, the contamination does not appear to have affected indoor air quality of surrounding homes and businesses. Additional information can be found on the MGP's website, *www.bayshoreworksmgp.com*.

ServAll Laundry was a laundry/dry-cleaning business which operated on Drayton Avenue in Bay Shore from 1972 until 1984. During that time, unknown quantities of washwater overflow were disposed without a State Pollutant Discharge Elimination System (SPDES) permit and sampling by SCDHS revealed wastewater and sludge were contaminated with tetrachloroethylene (PCE or "perc."), heavy metals and vinyl chloride. A vinyl chloride/PCE groundwater contamination plume was found to be emanating from the southeast corner of the site. A state-funded Remedial Investigation/Feasibility Study was completed in 1992, after which remedial design for the plume was completed in 1995. A groundwater pump and treat system began to be constructed in 1996 and operated from 1998 until 2001. Groundwater sampling and a soil vapor intrusion investigation were conducted from 2006 through 2008 with one well still showing contamination above the groundwater standard. Monitoring of this well will continue. The Site Health Assessment finds that drinking water quality in the vicinity of the site is not currently affected by the contaminant plume. Public water services the area of the plume, and those residences which had private wells in the area of the plume were connected to public water.

The Staver Company was a metal stamping shop whose operations at the site from 1950 to 1998 included cutting, stamping, buffing, tumbling, cleaning and degreasing small specialized metal parts. Signalex used a portion of the site from the 1980's to 2000 to assemble electromagnetic displays. A voluntary investigation was done in 2001/2002 from which sampling indicated the northern loading dock is the primary source of historical discharges of waste chlorinated solvents. Ownership was transferred in May 2004, and a small soil excavation to remove source material by the loading dock was performed in November 2004. However, a groundwater plume consisting mostly of tetrachloroethene and related byproducts was found to be moving south-southeast of the site from the north loading dock. An Air Sparge/Soil Vapor Extraction System (AS/SVES) has been in operation since October 2009 to treat on-site soil and groundwater contamination and to prevent vapor migration into the site building. The site is currently being used as a dog training center and as a medical office for physical therapy. Off-site groundwater sampling in 2009 did not detect any off-site groundwater contamination that had originated from this site. However, some fuel related contamination was detected and is believed to originate from a nearby gasoline station. The Site Health Assessment finds that contaminated soil has been excavated from the loading dock area and a fence erected to prevent access to the dock area. Indoor air monitoring is occurring on a regular basis and impacts have been observed. Monitoring is continuing and a soil vapor extraction system is planned on-site. NYS Department of Health and NYSDEC will be evaluating the data collected during the planned investigation to determine the potential for off-site impacts and the potential for soil vapor intrusion into structures on or near the site.

Table 2-11
Remediation Sites & Status

Site Name	Program	Estimated Size	Contaminants of Concern	Hamlet	Status
K-Bayshore MGP	State Superfund Program	10 ac	BTEX, PAHs	Bay Shore/ Brightwaters	In-Progress
ServAll Laundry	State Superfund Program	0.20 ac	VOCs	Bay Shore	In-Progress
The Staver Company, Inc.	Voluntary Cleanup Program	1.90 ac	VOCs	Bay Shore	In-Progress
Gibson and Cushman Dredging Co., LLC	Voluntary Cleanup Program	-	Arsenic, lead and zinc	Bay Shore	Remediation Completed
Rite Off, Inc.	State Superfund Program	3.00 ac	VOCs	Bay Shore	Remediation Completed
Brentwood Waste Disposal Site	State Superfund Program	0.25 ac	VOCs, SVOCs and metals	Brentwood	Remediation Completed

2.4 Land Use

2.4.1 Land Uses and Zoning

Updated land use for the Great Cove watershed was generated by compiling the Town of Islip year 2010 tax parcel database (which incorporates land use code data from Suffolk County Real Property) overlaid with Town zoning to identify degree of residential density, ownership information to identify publicly-owned lands. Aerial photo verification was utilized as needed. **Figure 2-8** provides a map of the compiled and updated land use information. The zoning map for the study area is provided as **Figure 2-9**.

To facilitate analyses, the study area was divided into four nonpoint source drainage areas (sub-areas). The area is densely developed with a large percentage of residential property and clustered commercial uses along the major roadways (Montauk Highway, aka Main Street, Sunrise Highway, and Route 111). In addition, industrial land uses prevail along the Long Island Railroad (LIRR) tracks and along Fifth Avenue in the northwest corner of the study area.

The land areas adjacent to the creeks which feed into Great Cove are largely developed and the majority of tidal creeks and canals are bulkheaded. Bulkheading is used extensively as a structural measure to protect and preserve individual properties. This convention resulted in a dramatic loss of wetlands prior to enactment of wetland protection regulations by the Town and State in the 1970s.

The quality of groundwater and stormwater runoff is largely dependent on land use. Overall, more than 67 percent of the watershed is comprised of high intensity land uses (e.g. medium and high density residential land uses, commercial, institutional, industrial, utilities, highway maintenance yards, transportation and waste handling & management). Medium-density residential is the single largest land use, comprising 21.7 percent of the overall watershed. It is followed by transportation (18.5 %) and high density residential (14.2%). The main east-west roadways help to define the local land uses. South of Montauk Highway is generally developed with a mix of residential, marine, and recreational use. Between Montauk Highway and Sunrise Highway, there is a mix of residential, commercial, institutional and industrial use. There is very little vacant property on the waterfront. Land uses are summarized in **Table 2-12**.

As further depicted in **Table 2-12**, land use analysis by sub-area reveals interesting trends. Generally, the central portion of the overall watershed contains the most high intensity land use (HILU), with Sub-area 2 (containing Penataquit and Awixa Creek) being the most impacted and 78.3 percent comprised of HILU. Sub-area 2 also contains the least amount of recreation and open space (4.2%). But both Sub-area 2 and Sub-area 3 (containing Orowoc Creek) have similarly large areas of medium density and high density residential land uses (combined totals of 40.1 and 40.0%, respectively).

Similarly, Sub-area 1 (containing Trues, Thompsons, Lawrence and Watchogue Creek) contains a total of 66.7 percent HILU, 38.6 percent of which is comprised of medium and high density residential land uses.

The least impacted is Sub-area 4 (containing Champlin and Quintuck Creek) which has the least amount of HILU (59.8%) and has the second largest amount of recreation and open space (17.5%).

Vacant and Publicly-owned Parcel Analysis

Using the Town of Islip year 2010 tax parcel database (which is based upon land use data from Suffolk County Real Property), Town-provided ownership information, and updated land ownership information from the NYS Department of Environmental Conservation, GIS software was utilized to identify publicly-owned parcels within the Great Cove area (see **Figure 2-10**). Additionally, the information was used to identify privately and publicly owned vacant parcels. Several vacant parcels are situated within or in close proximity to wetland areas owned and managed by the Federal Government, State, County or Town, but the majority of vacant parcels are landlocked with no apparent ownership at the time of analysis based upon the Town's parcel ownership information. All parcels identified as vacant or publicly-owned in the Great Cove Area are indicated in **Figure 2-11**.

Table 2-12
Land Uses by Sub-Area

	Sub-Area								**Grand Total**	
Land Use	**1**		**2**		**3**		**4**			
	Acres	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Surface Waters & Wetlands	139	2.9	69	2.1	228	6.3	121	2.0	557	3.1
Vacant	107	2.2	146	4.5	105	2.9	143	2.4	500	2.8
Flood Control/ Recharge Basins	18	0.4	46	1.4	28	0.8	51	0.8	142	0.8
Recreation & Open Space	851	17.7	138	4.2	299	8.3	1,054	17.5	2,342	13.2
Marina	21	0.4	10	0.3	4	0.1	11	0.2	46	0.3
Low Density Residential	459	9.6	298	9.2	438	12.2	1,048	17.4	2,244	12.7
Medium Density Residential	1,208	25.2	723	22.2	773	21.5	1,132	18.8	3,837	21.7
High Density Residential	645	13.4	585	18.0	669	18.6	605	10.0	2,504	14.2
Commercial	244	5.1	274	8.4	121	3.4	275	4.6	915	5.2
Institutional	108	2.2	141	4.3	188	5.2	496	8.2	932	5.3
Industrial	17	0.3	78	2.4	54	1.5	67	1.1	216	1.2
Utilities	28	0.6	8	0.3	26	0.7	11	0.2	74	0.4
Highway Maintenance Yard	2	0.0	4	0.1		-	93	1.5	99	0.6
Transportation	950	19.8	720	22.1	673	18.7	927	15.4	3,270	18.5
Waste Handling & Management	0	0.0	19	0.6		-		-	19	0.1
Grand Total	**4,797**	**100.0**	**3,260**	**100.0**	**3,605**	**100.0**	**6,036**	**100.0**	**17,697**	**100.0**
High Intensity Land Uses *(Med. Density Residential through Waste Handling & Management)*	3,202	**66.7%**	2,553	**78.3%**	2,504	**69.5%**	3,607	**59.8%**	11,866	**67.1%**

2.4.2 Public Access, Recreation and Open Spaces

There are a wide variety of public and private access opportunities, recreational areas and open spaces throughout the study area (see **Figure 2-12**). A selection of the more prominent recreation and open space areas are summarized below.

Central Islip

Suffolk County Environmental Center at the Scully Estate
The 70-acre County-owned Scully Sanctuary recently opened its Environmental Center in April 2010 with the assistance of the Seatuck Environmental Association. The Sanctuary borders the 200-acre Seatuck National Wildlife Refuge and boasts a diverse mix of upland and wetland habitats. The Center features a one-of-a-kind, 30-room mansion which is listed on the National Register of Historic Places. Seatuck operates the full-service nature center with a wide range of educational and cultural programs for schools, families and adults. For more information, visit *http://www.seatuck.org/nature-center.html* or call (631) 581-6908, Seatuck Environmental Association, P.O. Box 31, Islip, NY 11751.

Seatuck National Wildlife Refuge
The Seatuck National Wildlife Refuge is a 196-acre preserve bordering the Great South Bay and situated along the western bank of Champlin Creek at 500 St. Marks Lane, Islip. It was established in 1968 as a land gift from the Peters Webster Family and is managed as part of the Long Island National Wildlife Refuge Complex. The Refuge contains one remaining building from the Webster Estate, a barn which is listed on the National Register for Historic Places. Approximately one half of the refuge is comprised of tidal marsh and is an important year-round waterfowl area. Management activities include forest and grassland protection and management, wetland and habitat restoration, wildlife nesting structure maintenance. Although it is not open to the public, the NWR can be viewed from east side of South Bay Avenue in Islip, NY. An Audubon Sanctuary is located on the west side of the road. For more information, visit *http://www.fws.gov/northeast/seatuck/* or call (631) 286-0485, Seatuck Environmental Association, P.O. Box 31, Islip, NY 11751.

Islip Town Beach
The Town Beach is located at the end of South Bay Avenue and is accessible for residents with permits (Recreation Card) only. For information, visit *http://www.theislips.com/* , or call the Brookwood Hall recreation facility at (631) 224-5400.

East Islip

East Islip Marina & Town Beach
East Islip Marina and Town Beach (Hollins Memorial Beach) is located at the end of Bayview Avenue in East Islip, NY. The water front marina overlooks the Great South Bay. There is an outdoor water front restaurant, docking for town resident boats, a beach, and a ball field. A

Town of Islip Recreation Card is required to enter the East Islip Marina and Beach. For information, visit *http://www.theislips.com/*, or call the Brookwood Hall recreation facility at (631) 224-5400.

Heckscher State Park
The western edge of Heckscher State Park is located within the study area. Situated on Great South Bay at the southern terminus of Southern State Parkway, this year-round park offers 20 miles of trails for hikers, bicyclists and cross-country skiers. The Park boasts swimming in the Bay, a swimming pool complex, picnic areas, playing fields, playground, 69 camp sites and a boat launch. Free boat pump out facilities are available April 1 – November 1 from 7AM until sunset. For information, visit *http://nysparks.state.ny.us/parks/136/details.aspx* or call (631) 581-2100.

South Shore Nature Center
The South Shore Nature Center (formerly known as the Islip Meadows County Nature Preserve) is a 206-acre nature preserve located on Bayview Avenue in East Islip. The property was cobbled together over the years through acquisitions by The Nature Conservancy, Town of Islip, Suffolk County and NYS Department of Environmental Conservation. The Nature Center has been Town-operated since 1977. It contains a natural history museum and 2.5 miles of trails, half of which are wheelchair-accessible boardwalks, which are open to the public year round. The trails wind through upland woods, red-maple swamp, a freshwater pond and marsh, saltmarsh and sandy shoreline along Great South Bay. The nature center offers a variety of programs for school groups during the week, as well as for Islip residents and their families on weekends. The property is open 9 am to 5 pm every day from April through October. During the other months, it is closed on weekends. For information, visit *http://www.estuary.cog.ny.us/access_guide/site49.html* or call (631) 224-5436, 50 Irish Lane, East Islip, NY 11730.

Bay Shore

Gardiner County Park
This 231-acre nature-oriented County Park is located on the west side of the Great Cove study area on Great South Bay. Originally owned by the Gardiner family, Suffolk's first non-native landowners, it later became part of the historic Sagtikos Manor Estate and then became acquired by Suffolk County. The park entrance is located south of Montauk Highway, about one-half mile east of the Robert Moses Causeway. For more information, visit *http://www.co.suffolk.ny.us/departments/parks/Gardiner%20County%20Park.aspx*, or call (631) 854-0935.

Bay Shore Marina
Bay Shore Marina is located at the end of South Clinton Avenue in Bay Shore, NY. The marina overlooks the Great South Bay. There's a restaurant, small beach, a new water park and a large dock area for Town of Islip boaters. A Town of Islip Recreation Card is required to enter the

facility. For information, visit *http://www.theislips.com/*, or call the Brookwood Hall recreation facility at (631) 224-5400.

Maple Avenue Marina
Maple Avenue Marina is located at the end of Maple Avenue in Bay Shore, NY. For information, visit *http://www.theislips.com/*, or call the Brookwood Hall recreation facility at (631) 224-5400.

Ocean Avenue Dock
Ocean Avenue Dock is located at the end of Ocean Avenue in Bay Shore, NY. For information, visit *http://www.theislips.com/*, or call the Brookwood Hall recreation facility at (631) 224-5400.

Southward Ho Country Club
This is a privately-operated golf course in Bay Shore located near Gardiner County Park. For information, visit *http://www.southwardho.com/* or call (631) 665-1710, 601 West Montauk Highway, Bay Shore, NY.

2.4.3 Cultural Resources

As the majority of the watershed has been developed, very few nationally and/or state listed cultural and historic sites exist within the watershed. A total of six historic sites exist within the study area, four of which are located north of Montauk Highway (S.R. 27A) between 1st Avenue and 3rd Avenue (**Figure 2-13**). These four historic sites are comprised of two churches (First Congregational Church of Bay shore and Bay Shore Methodist Episcopal Church), the Bay Shore U.S. Post Office and the Bay Shore Hose Company No. 1 Firehouse. The remaining historical sites are located in West Bay Shore and Islip. Sagtikos Manor is located on the north side of Montauk Highway in West Bay Shore, north of Gardiner County Park. Wereholme, also known as the Scully Estate, is located in Islip on the west side of South Bay Road, west of the Seatuck National Wildlife Refuge.

Three archaeologically sensitive areas exist within the watershed and are located near the shoreline. Two of the areas are located in the vicinity of Wereholme and the historic resources located within Bay Shore, while the third area is located within the vicinity of Sagtikos Manor, and extends south and west.

2.4.4 Town Highway & Maintenance Facilities

There are six (6) Town highway & maintenance facilities within the Great Cove watershed as well as one (1) State facility and one (1) Village facility (see **Figure 2-10**). The Town facilities were inventoried in July 2010 by NP&V for the purpose of assessing pollutant potential and opportunities for improved use of Best Management Practices for each site. Two (2) of the Town facilities and the adjacent State facility are located in Central Islip near the NY Institute of

Technology Campus. The other four Town facilities are in Bay Shore and East Islip. The following section provides detailed information regarding each yard.

2nd Avenue, Bay Shore - Garage

The property is located on the east side of 2nd Avenue in Bay Shore and consists of a small office building, a small garage/storage building and a large repair facility. A second yard is located on the west side of 2nd Avenue at the intersection of Rhodes Avenue. This yard consists of an office/garage building, two (2) domed salt storage structures and a parking area for employees.

The main yard located on the east side of 2nd Avenue is utilized to store and repair trucks and equipment. The office building is located in the central portion of the western property boundary. The small garage/storage building is located to the south of the office building. This building contains a large open garage in which several pieces of equipment were stored along with drum storage. An open grate floor drain was observed in the center of the garage area. The discharge point of this drain was not determined. The large truck/equipment repair building is located along the north property boundary. This building contains a tire shop, a welding shop, four (4) repair bays with hydraulic lifts and locker room area. The remaining area of the property consists of paved parking area for the trucks and equipment. An above ground, covered and bermed tank storage area is located off the northeast corner of the building. Four (4) 1,000 gallon and one (1) 550 gallon tanks which contain waste oil, transmission fluid, hydraulic fluid, engine oil and anti-freeze are present in the tank storage area. No drains and only minor staining was observed on the floor of this storage area.

A truck washing area located in the southeast corner of the property has an open grate catch basin which was almost completely full of sand and silty material. This catch basin is in need of being cleaned out. Several open grate catch basins and staining from the trucks and equipment were observed throughout the parking area. A row of sand spreaders is located along the southern property boundary. All of the open grate catch basins are connected to a “positive” drainage system which discharges into Penataquit Creek to the east of the yard. All of the catch basins are piped to a single basin located in the central portion of the east property boundary. This basin is connected to an open grate catch basin located on the east side of Harrison Avenue which discharges untreated stormwater from the maintenance facility directly to Penataquit Creek through a twelve (12) inch corrugated steel pipe. This pipe is located in a drainage easement on the private property situated on the east side of the Harrison Avenue. The discharge pipe is visible through the side slope of the Penataquit Creek bank. An area of dark colored sediment appears to be present in the creek in the vicinity of the discharge pipe, and should be further assessed for potential contamination. There is significant opportunity to implement drainage improvements at this facility that would allow for stormwater retention and filtration to reduce the potential for contaminants to enter Penataquit Creek.

2nd Avenue, Bay Shore - Salt Storage Yard

This yard is located on the northwest corner of 2nd Avenue and Rhodes Avenue. The property is utilized for the storage of road salt in two (2) dome structures, brine mixing facility, temporary street sweeping stockpile, an employee parking area, vehicle fueling station with underground storage tanks and an office/garage structure. The two (2) salt storage domes located in the southwestern portion of the property contained rock salt used to de-ice roadways during the winter months. The temporary street sweeping stockpile area located in the northwest corner of the property is used to stockpile street sweepings from prior to the material being hauled to the landfill for final disposal. The inspection revealed this area consisted of bare soils on which the sweepings are dumped. The employee parking area is located in the northeast quadrant of the property and, the office/garage structure, brine mixing equipment and the vehicle fueling station are located in the southeast quadrant. The fueling station consists of two (2) underground storage tanks.

<u>Animal Shelter, Town Impound Yard and Former Town Landfill, Bay Shore</u>
These facilities are located on the South Service Road of Sunrise Highway, west of South Denver Avenue. The animal shelter and Impound Yard are located on the west side of South Denver Avenue. The former landfill has been capped and closed for many years; however, it reportedly received just about anything during the time span it was open. These facilities are located at the northern reach of Awixa Creek.

<u>Town Highway Garage Yard, Central Islip</u>
The main facility area is located on the east side of DPW Drive, west of Carleton Avenue. This facility consists of two (2) small fueling station buildings, three (3) office buildings, a vehicle fueling station, truck, equipment and ice spreader storage areas and a large open area on the southern half of the property which is occupied by several large stockpiles of road construction debris, dirt, sand and street sweepings. The fueling station consists of three (3) fuel pumps and two (2) 10,000 gallon underground diesel fuel and gasoline storage tanks. The truck, equipment and ice spreader storage area and the fueling station area are paved. Minor staining was observed in numerous locations throughout this paved area. No subsurface stormwater leaching structures were observed on any portion of the paved storage area. As result, all stormwater runoff is directed to natural surfaces to recharge. The southern half of the property consists of a strip of natural wooded area and a large area of bare soils on which numerous stockpiles are maintained.

A large paved area located on the western portion of the property, west of DPW Drive, is utilized as an un-covered salt storage area. This storage area is graded so all of the stormwater is collected in a low spot on the east side of the paved storage area. A four (4) inch pipe located in the bottom of the catch basin is utilized to drain the salty water into tanker trucks and transport it to a proper disposal point. **Champlin Creek** is located adjacent to the west side of the salt storage area. A small earthen berm was observed along the west boundary of the salt storage area. However, the proximity and un-covered nature of this salt storage facility to the Creek allows significant potential for excess sodium and chloride to leach into Champlin Creek.

A foot path located to the north of the salt storage is utilized by residents who live west of Champlin Creek. A makeshift bridge consisting of wooden pallets, plywood and lumber was observed in Champlin Creek. The materials of this makeshift bridge were observed to impede the flow of the creek. Construction of a footbridge at this location should be considered so that these debris can be removed.

Islip Park Department Maintenance Yard, Central Islip
Farther north from the Town Highway Garage, this facility is located on the west side of South Technology Drive, south of South Research Place in Central Islip. This facility is adjacent to the headwaters of Champlin Creek and consists of several large buildings and some small building used for the storage and maintenance of vehicles. The western portion of this property is located on the headwaters of Champlin Creek. This area is utilized as a stockpile of dirt, branches and debris collected from the various Town parks and for the storage of some equipment. A prefabricated garage style building is located in this area. The use of the building is unknown. The northern portion of the property is utilized for the stockpile of various materials and open empty drums which are most likely utilized as garbage cans in the Town parks.

Carleton Avenue Garage, East Islip
This facility is located on the northwest corner of Carleton Avenue and Union Boulevard in East Islip. This facility was a former car dealership that was converted into the existing Town vehicle maintenance facility. A fueling station was located at this facility until recently when the underground gasoline storage tanks were removed for replacement and a spill was detected. The building consists of an office area, a parts department, several service bays which have in-ground hydraulic lifts and a metal shop. An addition to the west end of the building consists of additional garages that are utilized to repair the lawn mowing equipment. A paved parking area used as employee parking and storage of Town vehicles is located in the northeast corner of the property. Numerous subsurface stormwater leaching pools were observed throughout the paved parking area.

2.5 Stormwater Infrastructure

Over the last 10+ years, the Town has made considerable effort to inventory and map the existing stormwater infrastructure within the Town boundaries. In 2003, NP&V finalized a Stormwater Outfall and Conveyance Identification and Mitigation Plan for the Town of Islip which focused on identifying stormwater sources that direct runoff to the tributaries of Great South Bay. The project area encompassed the entire south shoreline of the Town of Islip, and the tidal and non-tidal creeks which flow into Great South Bay. Following this initial identification of stormwater outfalls and conveyances, additional inventories were performed in an effort to identify and map upland drainage infrastructure that conveys stormwater runoff to the identified outfall locations. This infrastructure data collected included catch basins, leaching pools, recharge basins, other drainage structures and to the extent possible, the piping connections between drainage infrastructure in order to understand how the system is connected and the extent to which stormwater runoff collected in upland drainage infrastructure is conveyed to nearby surface waters.

Several sets of data were collected by various consultants and Town personnel; these data sets currently comprise the existing body of stormwater infrastructure information. The various data sets have been compiled and are maintained in the Town's GIS system. Data providers and dates the stormwater inventory were collected include: Bowne AE&T Group (2003), Cashin Associates, P.C. (2003 and 2005), Greenman-Pedersen Inc. (2005-2006 and 2008-2009), Town of Islip (2008-2009), Cornell Cooperative Extension of Suffolk County (2009-2011), Keyspan (date unknown) and Speck SpatialTech (date unknown). Additionally, updates to the drainage system mapping were also made based on information collected during field observations by Town and NP&V staff for this Watershed Management Plan. The collective results of these efforts are shown as **Plate 1**.

As clearly demonstrated by the Drainage Inventory Map (**Plate 1**), the extent of drainage infrastructure collected to date is extensive. The inventory shows that numerous outfalls to surface waters exist throughout the watershed, and in many cases there are considerable upland drainage connections to these outfalls. The majority of recharge basins are located along and north of Sunrise Highway. The majority of the Town's drainage system, particularly along roadways in the southern half of the watershed, consists of "positive flow" systems, or drainage systems where stormwater is collected in street side infrastructure and conveyed by gravity to surface water outfalls. This results in direct discharge of pollutants carried in stormwater runoff directly to surface waters and provides numerous opportunities for stormwater improvements throughout the watershed.

While the extent of stormwater infrastructure mapping is extensive, information gaps remain. The current compilation of infrastructure information was collected by eight different data providers, and there are inconsistencies in the data collected for each stormwater structure. As such, some of the data points have only spatial information associated with the point, and do not have information regarding the type of stormwater structure present at the location. In particular, the data collected by Speck SpatialTech was inventoried by utilizing satellite imagery for locating potential stormwater structure locations, and no field verification occurred for this data set. While this data set may be useful for preliminary identification of the potential locations of stormwater structures, field verification is necessary to collect further information regarding the individual stormwater structures to render the data set useful. As such, this data set has not been included in the analysis for this watershed management plan. Additionally, information regarding the connectivity of the various drainage systems (drainage piping) is inherently difficult to collect in the field due to the varying ability of the data collectors to see the installed piping (due to visual obstructions caused by debris or water in structures, the piping configuration, etc.). Stormwater pipe conveyances have not been fully inventoried within the watershed. As a result, piping information for this study is utilized where the data is the most complete and provides the most information.

Overall, the Town has made considerable efforts in identifying and mapping stormwater infrastructure in the Great Cove watershed area. Data gaps do exist; therefore continued efforts should be made to collect and further refine the infrastructure data and mapping.

SECTION 3

RECOMMENDATIONS

3.0 RECOMMENDATIONS

This section provides recommendations for improving water quality within the Great Cove Watershed. Recommendations stem from best management practices for watershed management as well as specific needs associated with the Great Cove watershed based on the Section 2.0, Watershed Characterization.

3.1 Preventive and Management Actions

A variety of pollution and water quality impairment sources have been identified as a result of the Watershed Characterization. Stormwater runoff has been identified as a leading non point source for discharge of pollutants into surface waters. Sediment, trash, road salts, oils, heavy metals and other chemicals from vehicles, pesticides and nutrients from lawns, bacteria and nutrients from pet waste and failing septic systems and sewer system leaks or overflows are all pollutants of concern that are transported into surface waters by stormwater runoff. Protection of water quality in urbanized areas is challenging, given the extent and proximity of impervious surfaces and pollutant sources to surface waters, large runoff volumes, limited areas suitable for surface water runoff treatment systems, high implementation costs associated with structural controls, thermal pollution from dark impervious surfaces and the absence of buffer zones that can filter pollutants and shade surface water bodies. Nutrients occur in the watershed as a result of sanitary wastewater, fertilization, pet waste, waterfowl, boat waste and wet and dry, organic and inorganic atmospheric deposition. Nutrients may be directly discharged to receiving waters, carried by stormwater runoff, or may occur as groundwater outflow from the aquifer to surface waters. Nutrients cause algae blooms, and resultant die-off consumes dissolved oxygen in surface waters causing oxygen depletion (i.e., hypoxic and/or anoxic conditions). Oxygen depletion causes fish kills and impairs the health and aesthetics of surface waters. Additional water quality impairment sources include industrial facilities, municipal facilities, marine craft, natural resource degradation and existing and proposed land use activities.

A comprehensive set of recommendations to address these water quality impairment sources is provided below in bullet and narrative form, with a summary matrix of recommendations, responsible entities, method of implementation, funding sources and preliminary prioritization provided in **Section 5.0**.

3.1.1 General Non-Point Source Control Measures

Recommendations

- Identify high impact stormwater discharges to surface waters and implement control measures on a priority basis. **Section 4.2** identifies sixteen (16) stormwater improvements projects to provide water quality treatment for existing direct discharges to surface water and increase detention and biological uptake of stormwater runoff.

- Encourage and/or incorporate low impact development elements into stormwater management requirements. Emphasize stormwater retention (bioretention and infiltration) at the source and incorporate discussion of stormwater management design options in early planning conferences between the Town and project developers during the review process.

- Develop incentives for developers and existing commercial property owners to incorporate low impact development and other green stormwater infrastructure control measures.

- Reduce existing unnecessary pavement wherever possible; this can occur as a result of site plan review of redevelopment sites, Town highway systems, municipal parking facilities, and other governmental installations. Less pavement in turn reduces generation of stormwater runoff that carries pollutants to receiving waters.

Source: http://naturalsystems.wordpress.com/category/general/

- Remove and/or reduce pavement adjoining surface water bodies to reduce thermal impact wherever possible.

- Contain all stormwater on-site for new development and site redevelopment projects; Town SWPPP requirements and stormwater requirements assist with review and control of private land use projects.

- Intercept stormwater in higher elevation areas wherever possible and provide surface detention, biological uptake, and vertical recharge capacity, to avoid confluence of stormwater and increased volume of flow at lower elevation areas; this primarily relates to existing Town, County and State road/highway systems.

- Incorporate green infrastructure practices to intercept stormwater close to the source and provide innovative stormwater management techniques using rain gardens, bio-swales, created wetlands, treatment forebays and related measures for stormwater containment where possible for new development, site redevelopment projects and Town/governmental facilities.

- Establish a regular monitoring and maintenance schedule for existing municipal stormwater systems, particularly catch basin and leaching systems retrofitted with filter inserts. If regular inspection and maintenance of stormwater systems can be integrated into the Town public works responsibilities, an expanded retrofit program should be explored for existing stormwater infrastructure in constrained areas with shallow depth to ground water (i.e., Bayshore Marina). See also Municipal Good Housekeeping recommendations in **Section 3.1.2** below.

- Expand vegetative buffers adjacent to waterways or downstream directed conveyance systems as a dissipation, sedimentation, shading and filtration mechanism for non-point source stormwater impacts.

- Support continued ban on the use of phosphorus containing products (i.e. laundry and dish detergents.

Discussion

Regulatory review should be completed to incentivize the use of low impact development and green infrastructure for new development and redevelopment projects proposed in the Town (i.e., specifically require use of bioretention areas within parking lot areas, re-establishment of stream buffers, provisions to permit use of pervious pavement, etc.). Sixteen specific stormwater infrastructure improvement projects within key areas of the Great Cove watershed have been identified as future corrective measures, with conceptual designs and preliminary feasibility to support future applications for grants and funding, detailed design and implementation (see **Section 3.2**).

3.1.2 Municipal Good Housekeeping

Recommendations

- Establish regular maintenance of storm water management practices, particularly practices with direct overflows to surface water and from stormwater hotspots (parking areas, highway yards, storage areas, etc.) as a priority action for Town highway personnel. The Town and other highway agencies should maintain stormwater practices to ensure that they do not become “clogged” with sediment, thus reducing their effectiveness as a sediment trap and removal mechanism for pollutants.

- Education of Town maintenance personnel on the need and benefits of regular maintenance of storm drains is a critical component of effective watershed management. Systems that may impact the watershed can be made more effective in minimizing impacts through minimal effort as compared with new projects. Sediment removal from catch basins is a classic example of how routine efforts can have a dramatic beneficial effect toward water quality improvement.

- Reduce use of chloride-containing road deicers within the Great Cove watershed. Expand the Town’s anti-icing program by increasing the practice of pre-wetting roads with de-icers prior to icing events. Liquid magnesium chloride, liquid calcium chloride or salt water can be sprayed on to roads before snow starts falling to prevent precipitation from forming a strong, icy bond with the pavement. Salt sprayed with liquid magnesium chloride can be used to enhance its melting capability in extremely cold temperatures. Pre-wetting also reduces the amount of salt spread during a storm, since larger quantities of dry salt are needed to de-ice a road in temperatures below 20 degrees (**PennDOT, undated**).

- Increase street sweeping activities to remove sediment from roads that may eventually be deposited in waterways.

- Inventory waterway systems and consider dredging in appropriate areas that may increase tidal flushing, reduce accumulated contaminated sediment flux to the water column, or have other cultural, recreational or aesthetic benefits.

- Evaluate municipal recharge basins for effectiveness in containing stormwater and removing pollutants. Recharge basins may experience reduced capacity as a result of sediment accumulation and in such cases should be maintained through removal of accumulated sediments, where appropriate. Older recharge basins with accumulated sediment that also include the presence of wetland vegetation should be surveyed to determine if the biological uptake, filtration, increased evapotranspiration and wetland value outweigh the reduced capacity in terms of stormwater detention and treatment. Such systems may be appropriate to leave in a more vegetative state and may not require maintenance; this should be determined on a case-by-case evaluation basis.

- The Town should further inventory all highway yards, and particularly salt storage facilities for winter highway de-icing, at minimum every three years in order to further identify needed improvements for corrective actions; preliminary inventory and best management practice recommendations are included in **Section 4.1**. It is critical that the Town properly manage salt storage facilities as past practices have been identified as a source of contamination as a result of existing Town facilities.

- Inventory all Town facilities for toxic and hazardous material handling, tank storage, maintenance practices; implement improvements, controls, best management practices and corrective as needed based on systems analysis.

- Gather and supplement data to determine corrective actions (if necessary) to address any issues with respect to the former Town landfill located adjacent to Awixa Creek.

- Coordinate with agencies having highway or other facilities within the Great Cove watershed (e.g., Village of Brightwaters and New York State) to perform inventory, identification of issues and implementation of corrective actions as needed to ensure that such facilities do not contribute pollution to the watershed.

- Train Town staff on municipal facility housekeeping practices, as necessary.

Discussion

Past practices at Town salt storage facilities have caused documented impacts to ground and surface waters and warrant corrective action. Penataquit Creek is one location that has been impacted by two (2) salt storage facilities (i.e. a Town facility and a private facility at the South Shore Mall). Water quality in this creek would benefit from the control measures outlined herein. All governmental/municipal facilities should seek to minimize their impact within the watershed.

3.1.3 Natural Resource Protection and Enhancement

Recommendations

- Protect existing wetlands for the continued benefit of stormwater filtration, nutrient uptake, erosion control, habitat, educational qualities, biological productivity and related essential functions.

- Retain and expand natural vegetation areas (i.e., by converting mowed lawn to areas of trees, shrubs, wildflower meadows) adjacent to surface waters within the watershed to ensure shading of water bodies to reduce water temperatures and related fisheries impacts, as well as to limit fertilizer impacts and provide filtration of stormwater.

- Restore wetlands vegetation wherever possible to reap the benefit of essential wetland functions as outlined above.

- "Daylight" streams where possible and restore naturalized flow of south shore creeks to reduce thermal impacts, rigid stream channelization and resultant flow modifications that have altered natural systems; where "daylighting" is possible, establish natural streamflow qualities and vegetative buffers for thermal cooling and stream protection.

- Control invasive species where possible in conformance with wetland improvement goals (e.g., *Phragmites*, Japanese knotweed) and vegetation management to avoid infestation and proliferation of unwanted species.

- Establish disturbed areas with native ground covers to eliminate and/or curtail infestation with invasive species (e.g., mugwort, garlic mustard).

- Identify and remove barriers to fish passage where possible to promote diadromous fish runs (i.e., fish that migrate between tidal and fresh waters to spawn and feed), thus restoring native fish species and the associated habitat, cultural, recreational and aesthetic benefits that result. Install bridges in areas noted to involve stream crossing activities. A makeshift bridge observed on Champlin Creek restricts water flow and should be removed, a footbridge could be considered at this location to promote stream crossing while maintaining flow characteristics.

Discussion

Natural systems have been severely impaired within the Great Cove watershed as a result of historic development patterns. While such impacts are evident, natural resources remain, and can be protected, as well as enhanced through reclamation activities. Protection will occur through NYSDEC and Town regulations and land use review practices. Reclamation will occur through direct Town or other government initiatives on Town owned land, and regulatory review of redevelopment. Protection and reclamation of natural resource qualities will benefit the flora, fauna, cultural, recreational and aesthetic qualities within the watershed, thus benefiting the Great Cove estuary and overall environmental conditions.

3.1.4 Land Use & Regulatory Measures

Recommendations

- Ensure that Town land use decisions (e.g. change of zones, subdivisions, site plans, variances) are made in a manner that considers the overall impact and potential improvement of conditions within the Great Cove watershed.

- Review and modify Town Code to allow for and incentivize adoption of Stormwater Management BMPs, such as bio-retention areas, reductions in impervious surfaces and porous pavement.

- Monitor past land use decisions for conformance to requirements to ensure that conformance has been achieved.

- Evaluate introduction of regulatory reductions for fertilizer dependent vegetation in newly proposed projects to the maximum extent (seeking to limit fertilized areas to no more than 15 percent of a site).

- Encourage the use of indigenous plants with low fertilization and irrigation requirements to the maximum extent practicable for new and redeveloped sites to reduce the application of fertilizers.

- Monitor, enforce and facilitate proper use of marine sanitation devices by providing pumpout facilities at Town and private marinas (through the land and use approval process) and ensuring "no discharge zone" education and enforcement.

- Encourage "pick-up-after-your-pet" practices through education and by providing pet waste bag receptacles at Town facilities.

- Manage waterfowl populations by reducing favorable conditions for waterfowl to congregate near surface water on private and public lands; encourage use of fencing, unmowed surface water and wetland vegetated buffer zones, and disruptive measures such as border collies and sonic devices where necessary. Adopt legislation prohibiting feeding of geese on municipal properties.

- Monitor current research in atmospheric deposition and trends relating to regional atmospheric pollution sources and depositional characteristics; Clean Air Act amendments are expected to result in reduced air emissions that contribute to atmospheric deposition of nitrogen; good sources for background and tracking of available literature include the Peconic Estuary Program and the Suffolk County Comprehensive Water Resources Management Plan.

- Acquire land through willing buyer/willing seller arrangements, and through condemnation where significant public purpose will be gained (i.e., stormwater/drainage projects, unique habitat, significant open space) and no other options are available. Establish priority criteria and apply to potential acquisition parcels to rank merits and form basis for decisions. **Figure 2-11** provides an illustration of existing publicly owned lands (by Village, Town, State and Federal ownership) and NYSDEC tidal and freshwater wetlands. Land that is available for sale should be explored first to determine if acquisition is warranted and would provide watershed protection benefit. Criteria for ranking evaluation include:
  - Proximity to tidal or freshwater wetlands (see **Figure 2-11**)
  - Proximity to 0-2 year groundwater contributing to surface water/creeks (see **Figure 2-4**; groundwater contributing areas)
  - Lands that are north of the Southwest Sewer District service area (see **Figure 1-2**; sewer district and unsewered areas)
  - Lands that possess habitat or buffer qualities that warrant protection
  - Lands that have potential to provide a location for drainage detention
  - Lands that are constrained as a result of shallow depth to groundwater

- Explore potential for transfer of development rights for sensitive parcels in watershed, to relocate development to other less sensitive, more appropriate locations. Development rights could be allocated for sending area parcels with development potential, and those development rights transferred to a location outside the watershed and/or to less sensitive areas.

Discussion

The Town is the authority that regulates zoning and land use within the watershed. Land use decisions should consider potential impact on the watershed to ensure that adverse water quality impacts are avoided. Regulatory actions, educational outreach, enforcement, and direct government action all play a role in reducing nutrient levels "at the source". If control occurs where nutrient load originates, non-point source discharge is reduced thus improving water quality.

3.1.5 Wastewater Management

Recommendations

- Provide sewers to unsewered areas wherever possible. Sewering provides wastewater treatment and nitrogen removal with groundwater discharge or surface water outfall. The majority of the Great Cove Watershed is sewered, with conveyance to the Southwest Sewer District for ocean disposal of treated effluent. Northern parts of the watershed remain unsewered (see **Figure 1-2**). The Southwest Sewer District should be extended where possible to serve existing high to moderately densely developed areas where district extension and/or out-of-district connections are feasible.

- New sewage treatment plants and/or connection to an existing sewage treatment plant (STP) should be provided for newly proposed projects that exceed residential densities greater than Article 6 (Suffolk County Sanitary Code) allowable on-site discharge. Smaller sewer area options should be examined for existing high density, unsewered areas in order to reduce existing nitrogen load exceeding Article 6 densities.

- Sewer main exfiltration and illicit connections should be examined in areas with reported sewer system overflows in order to determine leakage and control measures to prevent loss of untreated sewage from sewer main networks.

- "In-pipe" treatment technologies should be examined for potential use in reducing nitrogen concentrations in sanitary effluent prior to it reaching the STP.

- Innovative on-site wastewater systems should be explored for individual residential application, where larger scale sewering is not feasible, or for areas that conform with Article 6 densities, but may still cause adverse impacts to groundwater and downgradient surface waters.

- New STP locations should consider the potential impact on surface waters based on the time of travel zones for aquifer discharge to creeks within the watershed (see **Figure 2-4**). As noted in the figure, some 2-5 year contributing areas extend beyond the areas covered by the Southwest Sewer District.

- Legacy sanitary systems (i.e. systems remaining in the ground from prior to installation of regional sewering), should be pumped, sampled and backfilled when encountered in the watershed.

Discussion

SCDHS is in large part responsible for implementation of wastewater management recommendations. This agency implements Article 6 of the Suffolk County Sanitary Code for wastewater discharge and works in cooperation with SCDPW and the SCSA for sewering approvals of sewer district connections, new sewage treatment plants and wastewater discharge control. SCDHS is currently updating the Suffolk County Comprehensive Water Resource Management Plan, and has identified measures to reduce potential impact to groundwater and surface water. Through this study, the Town has identified specific concerns within the Great Cove watershed; the Town should seek to cooperatively engage SCDHS and County agencies in regulating, monitoring, enforcing and implementing the recommendations contained herein, all of which will assist in improving water quality in the Great Cove watershed.

3.1.6 Industrial Facility Control

Recommendations

- Industrial facility inspection, monitoring, enforcement and cleanup should occur on a priority basis for businesses that use and/or store toxic or hazardous materials in the Great Cove watershed area.

- Town regulatory review and NYSDEC SPDES Multi-Sector General Permit requirements should be implemented to ensure industrial facility and marina/waterfront facility incorporate best management practices into daily operations and facility maintenance. Known sources and known remediation sites should be monitored for compliance with enforcement actions, consent orders and cleanup plans.

- Ensure tank registration and compliance to curtail or eliminate release of product from regulated tank systems as applications for building permits or site plans are submitted the Town.

- Continue to monitor remediation efforts of the former Manufactured Gas Plant (MGP) in the Lawrence Creek watershed by National Grid, with oversight by NYSDEC and the New York State Department of Health and the participation of community groups.

<u>Discussion</u>

SCDHS is primarily responsible for activities involving storage and handling of toxic or hazardous materials under Articles 7 and 12 of the SCSC. The Town should seek to cooperatively engage SCDHS regulating, monitoring, enforcing and implementing measures to ensure proper storage and handling of these materials in the Great Cove watershed.

3.1.7 Education and Outreach

<u>Recommendations</u>

- Town government provides an excellent vehicle to disseminate information to educate the public on the need for watershed protection: Town web site, mailings, education and interpretive signs at Town facilities, contact of Town officials with interest groups (e.g., Keep Islip Clean, Suffolk County Environmental Center, SELF Program, etc.) and targeted businesses (e.g., landscapers, nurseries/home improvement stores, etc.), regulatory compliance interaction and general public outreach (e.g., school interaction, board meetings, etc.) provide opportunities for public education.

- Install "pick-up-after-your-pet" dispensers at Town facilities, and provide interpretive and educational signage in Town parks stressing importance of proper pet waste disposal and discouraging feeding of geese.

- Implement an "Adopt-A-Drain" program (possibly with the assistance of Keep Islip Clean) asking residents to aid in the monitoring of catch basins near their homes to 1) remove debris from grates and catch basin openings following storm events, and 2) inform the Town when drains are in need of cleaning.

- Educate boat owners who rent slips in Town parks through slip license agreements that include educational information and notifications concerning clean boating practices (e.g., local pump-out information, clean boating pamphlet, free bilge sock, importance of proper trash disposal, etc.).

- Promote continuation and expansion of volunteer monitoring throughout the watershed to promote interest, increase stewardship of waterways, and collect water quality data particularly on creeks without any sampling in recent years.
    - Continuation of South Shore Estuary Learning Facilitator (sSELF) Program (currently in Champlin, Penataquit, Lawrence, Brightwaters) - *www.NYSMEA.org*
    - Expansion of Long Island Water Sentinels program into Great Cove watershed - *www.liwatersentinels.org*

- Distribute and otherwise make available (e.g., Town website, Town Hall, Suffolk County Environmental Center) a series of outreach materials that have been prepared as part of the Great Cove Watershed Management Plan. These materials, listed below, are intended to provide property owners with information on LID principles and BMPs, as well as provide do-it-yourself tips for retrofitting existing properties (provided in **Appendix E** of this report):
  - Resident's Guide to Keeping Great Cove… Great!
  - 4-Season Yardworker's Tipsheet
  - Stormwater Guide for Town of Islip Municipal Officials
  - Designing a Rain Garden
  - Solution to Stormwater Pollution (EPA Mailing tailored for Islip)

Discussion

Promoting environmental stewardship is critical to increasing awareness of the impacts of stormwater on watershed resources. Stewardship through education, implementation of stormwater best management practices, clean-up events, and water quality monitoring can be accomplished by partnering with existing organizations to sponsor educational outreach efforts (e.g., Keep Islip Clean, sSELF Program, Suffolk County Environmental Center at the former Scully Estate, Long Island Water Sentinels Program, etc.). The Town is in an excellent position to facilitate educating the public, as the level of government closest to the public and with the most local representation of the "average" person in the Town of Islip. All efforts should be made to effectuate public education as part of the Town's stormwater management program, Town representative interaction with the public, regulatory procedures, and outreach into the community through the Supervisor's office, planning and environmental departments, highway departments and all available public contact portals.

3.1.8 Water Quality Monitoring Recommendations

Recommendations

- The Watershed Characterization **(Section 2.0)** provides an important synopsis of ground and surface water monitoring that has occurred in the Great Cove watershed (i.e., creeks, streams, surface waters, groundwaters, beaches). Unfortunately, many data gaps are evident in constituents monitored (e.g., macroinvertebrates, nutrients, organics, bacteria, etc.), geographic areas covered (i.e., spatial monitoring) and time periods covered (i.e., temporal monitoring). These data gaps should be filled in order to best understand the current conditions of the watershed, track water quality improvements, and provide a basis for future management decisions. Monitoring of creeks that have not historically been monitored or have not had follow-up monitoring since the FAN study should be priorities (i.e., Quintuck Creek and Watchogue Creek).

- Coordinate with other levels of government, as well as research institutions (e.g., SUNY Stony Brook, the New York Water Resources Institute, or similar research organizations) to implement monitoring programs consistent with this plan; SCDHS should be encouraged to continue and expand monitoring with other partners (e.g. USGS, NYSDEC RIBS, South Shore Estuary Learning Facilitator (sSELF) project, LI Water Sentinels, etc.) enlisted to assist with this program.

- Promote continuation and expansion of volunteer monitoring throughout the watershed to promote interest, increase stewardship of waterways, and collect water quality data particularly on creeks without any sampling in recent years.
  - Continuation of South Shore Estuary Learning Facilitator (sSELF) Program (currently in Champlin, Penataquit, Lawrence, Brightwaters) - *www.NYSMEA.org*
  - Expansion of Long Island Water Sentinels program into Great Cove watershed - *www.liwatersentinels.org*
  - Established protocols for water quality monitoring procedures and data management should be established and enforced. SCDHS, NYSDEC and EPA are sources for standard protocols. It is also suggested that any volunteer monitoring program be managed by a qualified individual to sure quality assurance and consistency for effective, long term use of the data.

- Maintain a water quality monitoring map identifying monitoring locations and monitoring groups (utilize **Figure 2-3**, Water Quality Monitoring Stations, as a base). (Keep Islip Clean could potentially assist with the administrative aspect of teaming volunteers with sampling locations).

- Monitor State initiatives to establish numerical standards for surface waters and support monitoring and watershed protection efforts to achieve establish standards through management and restoration efforts.

<u>Discussion</u>

Monitoring occurred for the FANS study in the 1970's and only limited monitoring has occurred since. The Town through this study has compiled existing available data and this assists with identification of data gaps. The Town is in an excellent position to partner with agencies that have the necessary monitoring resources to fill data gaps toward a better understanding of the ground and surface water systems within watershed, as well as to facilitate tracking of the effectiveness of watershed management. Quintuck Creek has not been monitored and Watchogue Creek has had only limited monitoring. Additionally, monitoring of parameters of concern, such as temperature in Champlin Creek and sodium levels in Penataquit Creek, should be targeted for implementation of water quality monitoring.

3.1.9 Enforcement Recommendations

Recommendations

- Town attorney, bay constable, zoning compliance officers and related Town officials should seek to ensure that illicit discharges, waterway protection, litter and dumping, non-compliant site activities, and general activities within the Town are conducted in a manner consistent with the laws on the books of the Town, particularly where such activities may impact the health and/or environmental integrity of the Great Cove watershed.

- The Town should monitor and report activities not under their purview, but which may involve other laws of regional and/or State government that adversely impact land or water within the Great Cove watershed.

- Consider establishment of regular Town monitoring of erosion controls at active construction sites to ensure enforcement. The application fee structure should be modified to allow for reimbursement of such inspections by the applicant.

- Require bonds for cleaning of sediment or construction debris from streets, drainage structures or waterway restoration prior to the start of construction to ensure any impacted areas are restored.

Discussion

Enforcement is unfortunately an integral part of achieving compliance. Town, regional and State level regulations must be enforced by appropriate levels of government to ensure the integrity of land and water use in the Great Cove watershed.

SECTION 4

CORRECTIVE ACTIONS

4.0 CORRECTIVE ACTIONS

This section provides recommendations for improving water quality within the Great Cove Watershed. Recommendations stem from best management practices for watershed management as well as specific needs associated with the Great Cove watershed based on the Section 2.0, Watershed Characterization.

4.1 Municipal Highway & Maintenance Facilities

Assessments of the six Town highway & maintenance facilities within the Great Cove watershed were conducted by NP&V in July 2010 during the preparation of this plan (see **Section 2.4.4**). The facilities were inventoried for the purpose of assessing pollutant potential and opportunities for improved use of Best Management Practices for each site. Based upon those assessments, the following recommendations should be implemented at the Town Facilities to improve the Town's stewardship of its water resources.

<u>Global Facility Recommendations:</u>

Vehicle Washing

- Designate a covered area for vehicle washing
- Install a wash water recycling system
- Use phosphate-free, non-toxic, biodegradable soaps

Salting

- Regulate and vary salt amounts to reflect site characteristics such as road width, design, traffic, and proximity to open water. In salt sensitive areas roads should be sanded instead of salted.

Stock Piles

- Create a storage area for stock piles with an elevated impervious floor to prevent runoff from entering the pile; the stock pile should also have a physical barrier around it, preferably an enclosed space, to avoid creeping.
- The yard should be studied to find an appropriate placement for stock piles away from streams and runoff paths.
- Brine runoff from stock piles should be contained and reused.

Fueling and Maintenance

- All vehicles should be parked on paved surfaces and should be regularly checked for leaks. If leaks are present drip pans should be used until maintenance is possible.
- Any maintenance operations, including fueling, should occur in indoor (or at least covered) area with a paved impervious floor (i.e. concrete, cement).

- When changing fuel or oil drip pans should be used.
- Vehicles awaiting repair should be parked in a shed or under a roof.
- During fueling temporary caps or berms for catch basins should be used to protect from potential spills.
- Do not "top off" fuel tanks, this prevents spills.
- Plan for maintenance when the forecast calls for dry weather.

Spills

- All sites should have a spill prevention and reaction plan.
- Spill kits should be placed where vehicle maintenance and fueling occur. Spill kits include – absorbent materials, dry materials (kitty litter, sawdust), brooms (do not use a hose to clean up a spill), instructions, emergency contact numbers for spill response personnel.

Training

- All employees should receive training in best management practices.
- Signage regarding best management practices should be placed around the site.

Tracking

- Inventory and records should be kept for all materials at the site (sand, gravel, salt, hazardous chemicals, etc.). These records should include when materials arrive or leave, are disposed of, or are cleaned.
- Every vehicle should have its own record stating when they are cleaned, repaired, or filled with fuel.
- The site should be monitored for the amounts of runoff and where it is occurring.
- Any catch basins on the site should have its own record of when it is cleaned.

Hazardous Chemicals

- All chemicals should be labeled properly and clearly. Labels should be clean and visible at all times. Labels should include: chemical name, unit number, expiration date, handling instructions and health or environmental hazards.
- Containers should be stored on elevated spill platforms preferably indoors.

General Housekeeping

- Maintain loading areas and sweep all pavement regularly.

<u>Specific Facility Recommendations:</u>

4.1.1 2nd Avenue, Bay Shore - Garage

- Regularly remove sediment from the open grate catch basins within the parking area and monitor filter inserts to determine need for replacement.
- Retain and establish a regular monitoring and maintenance schedule for existing catch basin inserts to ensure proper functioning.
- Install water quality treatment structure to intercept stormwater from the existing positive overflow to provide for infiltration of stormwater and reduce runoff directed to Penataquit Creek.
- Establish truck wash with oil/water separator. Overflow from oil/water/separator may be discharged to the sewer system subject to SCDPW industrial waste permit or to a leaching pool subject to an injection well permit from EPA.
- Establish perimeter barriers for stockpile areas to avoid "creep" of stockpiles and spread of sediment within parking areas.
- Establish regular maintenance schedule for collection and proper disposal of sediment within parking lot areas.

4.1.2 2nd Avenue, Bay Shore - Salt Storage Yard

- Provide canopy for the existing fuel pump at the salt storage yard and install water treatment structure or catch basin insert at the existing inlet adjacent to the fueling pump.
- Establish perimeter barriers for stockpile areas to avoid "creep" of stockpiles and spread of sediment within parking areas.
- Continue to sweep parking lot to ensure road salt is properly contained.
- Prohibit washing of vehicles on site. Vehicles should be washed at stations proposed at the adjacent Town highway yard or at a commercial car wash.

4.1.3 Animal Shelter, Town Impound Yard and Former Town Landfill, Bay Shore

- No immediate remediation needs observed.
- Ensure all pet waste continues to be properly disposed and not able to enter adjacent water ways via stormwater runoff.

4.1.4 Town Highway Garage Yard, Central Islip

- Limit the ability of excess sodium and chloride to leach into Champlin Creek by covering and relocating the current un-covered salt storage facility to the east (see **Section 4.2** for specific recommendations).

- Install drainage structures and catch basin filter inserts to capture and treat runoff from the paved storage areas/roadways.
- Establish truck wash with oil/water separator. Overflow from oil/water/separator may be discharged to the sewer system subject to SCDPW industrial waste permit or to a leaching pool subject to an injection well permit from EPA.
- Install canopy for fueling station.
- Establish perimeter barriers for stockpile areas to avoid "creep" of stockpiles and spread of sediment within parking areas.
- Continue to sweep parking lot to ensure road salt is properly contained.

4.1.5 Islip Park Department Maintenance Yard, Central Islip

- Establish perimeter barriers for stockpile areas to avoid "creep" of stockpiles and spread of sediment within parking areas.
- Prohibit washing of vehicles on site. Vehicles should be washed at stations proposed at the Town highway facility or at a commercial car wash.

4.1.6 Carleton Avenue Garage, East Islip

- No immediate remediation needs observed.

4.2 Stormwater Improvement Projects

As described in Section 2.5, stormwater infrastructure in the Town is largely comprised of positive overflow systems, which discharge stormwater runoff (and the pollutants carried in this runoff) directly to surface waters. Watershed-wide recommendations have been provided in Section 3.1 to offer planning considerations and future actions that can be implemented on a Town wide basis. Specific best management practices (BMPs) to help reduce pollutant loads from stormwater runoff are discussed below and are recommended for consideration in both municipal improvement projects and for use by private development. Stormwater BMPs may provide pollution source reduction, pollutant removal and flood control. The NYSDEC issued an updated Stormwater Design Manual in August 2010 (hereafter "2010 Design Manual") which includes new guidance on the use of low impact design (LID) principles (i.e., preservation of open space and clustering development, reduction of impervious surfaces, retention of natural buffers, etc.) to reduce runoff volumes generated from development activities and the use of green infrastructure practices to utilize natural features to promote groundwater recharge and emulation of preconstruction hydrology. Green infrastructure techniques include smaller scale practices such as rain gardens, cisterns, green roofs, vegetated swales, porous pavement and stormwater planters intended to provide water quality treatment close to the source. The 2010 Design Manual also includes a wide variety of more conventional and larger scale stormwater management practices such as stormwater ponds, stormwater wetlands, infiltration practices including biorention areas and vegetated swales, and proprietary technologies for retrofitting more urban settings. **Table 4-1** summarizes the various practices considered in developing stormwater improvement projects and retrofits within the Great Cove watershed. Given the density and existing infrastructure of much of the watershed, as well as the limited land area available for stormwater improvements, retrofitting of existing drainage infrastructure was considered and incorporated in cases where standard stormwater BMPs were not infeasible.

Table 4-1: Stormwater Best Management Practices

BMPS	DESCRIPTION		LAND USE & LOCATION SUITABILITY	SIZING CRITERIA	EFFECTIVE FOR WATER QUALITY (1)
Infiltration Systems	Practices that capture and temporarily store the full water quality volume before allowing it to infiltrate the soil.		Site conditions dictate if good for rural and urban-urban land use. Residential Subdivision Use, High Density/Ultra-Urban, Not to be placed under pavement or concrete. Addresses water quality.	Group-wide criteria: soils need to have infiltration rate of at least 0.5"/yr, practices occupy 2-3% of contributing drainage area, must be 3-4' above groundwater table.	✓
	Infiltration Trench	An infiltration practice that stores the water quality volume in the void spaces of a gravel trench before it is infiltrated into the ground. Can only capture a small amount of runoff (I.e. first flush) and therefore, often used in combination with another BMP such as detention basin.	Site conditions dictate suitability for residential land use, good for roads, highways and commercial/high density.	Max 5 ac. drainage area, 15% or less slope, 1' head	✓
	Infiltration Basin	An infiltration practice that stores the water quality volume in a shallow depression, before it is infiltrated into the ground.	Good for residential land uses, not suitable for roads/highways, site conditions dictate suitability for commercial/high density.	Max 10 ac. drainage area, 8% or less slope, 3' head	✓
	Dry Well	An infiltration practice similar in design to the infiltration trench and best suited for treatment of rooftop runoff	Good for residential land uses, never good for roads & highways.	Max 1 ac. drainage area, 8% or less slope, 1' head. If site with less than 75% impervious cover will require	✓
Filtration Systems	Use some combination of a granular filtration media such as sand, soil, organic material, carbon or a membrane to remove constituents found in runoff. Quantity control can be included by providing additional storage volume in an associated pond or basin. Generally filters are multichamber structure that treats runoff through filtration using a sediment forebay, a primary filter median and an underdrain collection system.		Good for residential & ultra urban land uses with high percentage of impervious cover.	Group-wide criteria: most soils, head 2-7', practices occupy 2-7% of contributing drainage/impervious area, groundwater table must be at least 2' below filter bottom	✓
	Bioretention	A shallow depression that treats stormwater as it flows through a soil matrix and is returned to the storm drain system. Includes grass buffer strips, ponding area, organic mulch layer, planting soil bed, sand bed and plants.	Good for roads & highways. Seldom or never in rural or residential land uses. Parking lot islands, landscaped areas around building, perimeter of parking lots, individual residential lots (often referred to as rain gardens). Planting soils must meet criteria and use of native plants recommended. Addresses water quality.	Max 5 ac. drainage area, 6% or less slope, typically require 5% area of contributing impervious area.	✓
Open Channels	Vegetated open channels that are designed to capture and treat the full water quality volume within dry or wet cells formed by check dams or other means.		May have residential subdivision use, Good for rural and road/highways. Addresses water quality.	Group-wide criteria, 5 ac. Drainage area max, site slope nor more than 4%, 1' head, side slopes gentler than 2:1 (3:1 preferred)	✓
	Dry Swale	Open vegetated drainage channel or depression designed to detain water within dry cells formed by check dams or other means. Promotes filtration of stormwater runoff into the soil media. Permeable soil layer.	May be okay for residential/subdivision use, urban-urban use & commercial/high density use. Ideal for open section roads and low density residential streets. Use where standing water not desired, Addresses water quality.	Max 5 ac. drainage area, 4% or less slope, typically requires 10-20% area of contributing impervious area, 2' above groundwater table, made soils	✓
Other Vegetated Systems (biofilters)	Grassed channel (also vegetated channels, grassed swales, vegetated swales)	Grassed channels that collect and convey runoff usually to a basin or another BMP. Designed to treat shallow flows. Designed to filter stormwater runoff and meet velocity targets for the water quality design storm and the 2-year storm event.	Residential Subdivision Use. Use for pretreatment, runoff reduction/impervious cover disconnection and as curb and gutter replacement. NYS deems as pretreatment, treatment of small portion of site or supplemental method only. Not deemed effective for stand-alone water quality treatment.	Typically requires 5% area of contributing impervious area. Max 5 ac. Drainage area, 10-20% of total drainage area required for BMP. 2-5' head, not on slopes >4%, recommend 1-2%, bottom width of trapezoid or parabola 2-8', slopes 3:1 or flatter	X
Other Vegetated Systems (biofilters) continued	Vegetated Filter Strips	Grass or other vegetation planted within uniformly graded areas which accepts sheet flow runoff from adjacent surfaces such as parking lots, highways and rooftops. Slows runoff velocity and filters out sediments and other pollutants through filtration and infiltration. Used in combination with riparian/wetland buffer to treat sheet flows and in stabilizing streambanks	Residential subdivision use, area adjacent to streambanks or riparian/wetland buffers. Applications: pretreatment, runoff reduction/impervious cover disconnection; and use in buffer system. NYS deems as pretreatment, treatment of small portion of site or supplemental method only. Not deemed effective for stand-alone water quality treatment.	BMP surface area is 100% of contributing impervious area, BMP required 25% of total drainage area, negligible head requirement, area typically serviced less than 5 ac.	X
	Vegetated Buffers (grassed and treed) i.e. Wetland and Riparian buffers	Native or planted vegetation along edges of sensitive environmental resources which slows runoff velocity and filters out sediment and pollutants. Controls erosion of banks.	Upland areas, slopes, land areas adjacent to surfaces waters, bluffs, streambanks, drainageways.		X

(CONTINUED) BMPS	DESCRIPTION		LAND USE & LOCATION SUITABILITY	SIZING CRITERIA	EFFECTIVE FOR WATER QUALITY (1)
Other Infiltration Systems	Porous pavement systems	Stormwater runoff is infiltrated into the ground through a permeable layer of pavement or other stabilized permeable surface (I.e. porous asphalt, porous concrete, modular perforated concrete block, cobble pavers with porous joints or gaps or reinforced/stabilized turf.	Overflow parking lots, driveways, roads and other paved areas not exposed to high volumes of traffic, heavy equipment, or high amounts of sediment. NYS deems method as a pretreatment or supplemental method, and not effective for stand-alone water quality treatment.	Drainage acreage should be less than 5 acres. Area not sanded nor salted during winter. No high volume traffic nor sediment.	
Dry Ponds (i.e. Detention Basins, Dry Extended Detention Ponds, Extended Detention Basins/Ponds)	Basins designed to temporarily detain runoff for some minimum time and releases shortly after storm event (usually within 24 hours) . Reduces peak flow rate of stormwater discharges. Used for water quantity control only.		Residential/Subdivision use. NYS states practice not capable of providing water quality treatment alone but can function as pretreatment, treatment of small portion of site or as a supplemental practices.	Acceptable for large drainage areas. Pre-treatment required for stormwater hotspots.	X
Hydrodynamic Structures & Baffle Water Quality Structures includes non-proprietary systems noted below and proprietary systems.	Specifically designed, baffled inlets, remove or segregate trash, debris and some amount of sediment and petroleum hydrocarbons from stormwater. Operate by principles of sedimentation for grit and phase separation for oil. Minimal flow attenuation and not designed for significant detention storage.		Used in retrofit situations to provide some water quality treatment for small urban lots where larger BMPs not feasible. Best used in impervious areas with high sediment and hydrocarbon loadings especially commercial, industrial and transportation land uses. NYS deems as pretreatment, treatment of small portion of site or supplemental method only.	Typically contributing area to any individual inlet limited to one acre or less of impervious cover. Less than 1% of area required from BMP. 2-5' head required. Can be used for retrofitting small urban lots where larger BMPs are not feasible or where above-ground BMPS are not an option. Requires aggressive maintenance plan.	X
	Hydrodynamic Swirl Seperator	Uses chambers to "swirl" & trap sediments and and retain nps pollutants.	Used in retrofit situations to provide some water quality treatment for small urban lots where larger BMPs not feasible. Best used in impervious areas with high sediment and hydrocarbon loadings especially commercial, industrial and transportation land uses.	Recommends use: redevelopment project of >2500 sq.ft. where there was no previous stormwater management, projects that double impervious area.	X
	Baffle Water Quality Devices	Consists of 3 bays: forebay for sediment trapping, separator section for oil separation and afterbay allows for some settling but generally stormwater is routed out to another BMP or storm drain system.	Same as above	Combined volume of 3 bays should be maximized and should equal at least 400 cu. feet per acre of contributing impervious area.	X
	Deep Sump Catch Basins	Modified catch basin with the outlet pipe 4' below the inlet pipe. Allows suspended solids to settle out and oil and grease to float on surface of pool of water. Eventually oil and grease attach to sediment. Must be cleaned out for it to be effective.	Same as above	Same as above.	X
Catch Basin Insert	Designed to be suspended from storm drain inlet structure. Treats only the designed flow rate, should have a high-flow bypass to prevent resuspension and washout. Can contain one or more treatment mechanisms, including filtration, sedimentation or gravitational absorption of oils. Not suitable for removal of fine particulate stormwater pollutants (i.e. metals, nutrients, silts or clays).		Unpaved areas where sediment concentration is expected to contain coarse material. Sites where stormwater has lots of debris. Use in unpaved roads, parking areas, construction sites, unpaved industrial sites and lumber yards. NYS deems as pretreatment, treatment of small portion of site or supplemental method only.	Typically services less than 1 acre, no area required for bmp, 1-2' head. Designed to perform acceptably for a reasonable design storm (i.e. 2-yr. rainfall event based on hydrologic characteristics and percent of imperviousness of site).	X
In-line storage in the storm drain network	Collection of stormwater runoff from parking lots and roadways; allows for percolation of runoff. Provides storage within storm drain system to detain flows.		In areas where there is adequate depth between the bottom of leaching pools and leaching catch basins and seasonal high water table. Acts as a surrogate for aboveground storage when little space available for aboveground storage facilities.	Pipes must be oversized to prevent upstream flooding. Slopes of existing piping system must be neither very flat or steep. Consumes little surface area.	X

(1) Practices noted as effective BMPs for addressing water quality by NYSDEC if met water quality goals: 80% TSS (suspended inorganic and inorganic material) reduction; 40% TP removal and a proven record of longevity in the field.

Sources:

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NJ Department of Environmental Protection, 2004. NJ Stormwater Best Management Practices Manual.

NYS Department of Environmental Conservation August 2010 New York State Stormwater Management Design Manual.

U.S. Environmental Protection Agency, August 1999. Preliminary Data Summary of Urban Stormwater Best Management Practices. EPA-821-R-99-012.

A total of 16 drainage improvement projects were conceptually designed utilizing the measures outlined in Table 4-1 (detention, settling, infiltration, and filtration) in order to decrease the peak stormwater flow rate and remove pollutants (e.g. oil and grease, metals, nutrients, sediment) from the stormwater discharging directly to surface water. Drainage improvement projects were selected based on stream and water quality impairments (as summarized by Table 2-4), land use and impervious cover within contributing area (as summarized by **Table 2-12**), proximity of potential pollutant sources to the streams and availability of publically owned land in proximity of streams for placement of drainage improvement projects. Additionally, three projects were selected as representative projects for a common stormwater problem found in multiple locations throughout the Town (i.e., discharge of stormwater directly from roadside catch basins). Each of the stormwater improvement projects is described below. For each location, a conceptual plan depicting the proposed improvements is provided, as well as a larger scale drainage infrastructure map showing the existing stormwater infrastructure in the vicinity of the project, surrounding roadways, tax parcels, publically owned lands and approximate freshwater wetland boundaries associated with the adjacent surface waters. Details of the potential stormwater BMPs considered in these designs are provided in **Appendix F-1**. It is noted that many of the projects are in close proximity to freshwater or tidal wetlands and would be subject to wetlands permitting requirements. Ultimately property and surrounding area surveys, wetland flagging, full engineering design plans and permitting would be necessary prior to installation of these improvements.

4.2.1 Project 1: Archie Place (Trues Pond)

Trues Pond is approximated 0.2 acres in size and located on the north of Montauk Highway, just west of Trues Creek in West Islip. The Pond has multiple existing stormwater outfalls which discharge stormwater runoff collected from the surrounding residential neighborhoods and roadways directly to the Pond (see Drainage Infrastructure Project 1 figure). A narrow fridge of vegetation surrounds the Pond and water fowl populations are present. Water quality monitoring of Trues Creek reveals significantly high levels of ammonia, nitrogen and bacteria, as well as low pH and dissolved oxygen levels. The Town owns the land underlying Trues Pond, as well as a small triangular parcel adjacent to the northeast of the Pond (located at the intersection of Lakeview Ave. and Archie Place). Roadside catch basins surround this triangular parcel, and discharge stormwater directly to Trues Pond. The proposed drainage improvement project proposes the creation of a biorention area in the triangle parcel and redirecting the existing direct discharges to the biorention area for filtration and pollutant removal prior to overflow into Trues Pond. Additionally, the northwest side of the Pond has small area of lawn which has adequate area to install an offline water quality treatment structure. The existing stormwater outfall would be directed to this subsurface water quality structure; which could provide for filtering of stormwater runoff through filter media, as well as removal of sediment, debris and floatables. Treated stormwater would then overflow to the existing stormwater outfall.

Public educational opportunities also exist at this location, as the Pond is frequently used by the surrounding neighborhoods for passive recreation. Signage educating the public of issues such as the importance of proper pet waste disposal or describing the benefits of biorention could be readily visible to walkers and passersby. Presently there is a sign posted at the Pond which indicates that a local Girl Scout Troop has adopted the Pond; thus this organization may be a good source for continued stewardship of the Pond.

4.2.2 Project 2: Montauk Highway at Lawrence Creek

This stormwater improvement project represents a common condition along Montauk Highway, as well as other roadways in areas where minimum depth to groundwater exists. Currently, stormwater runoff from surrounding roadways is piped to drainage infrastructure along Montauk Highway (NYS owned) and directly discharged via positive (gravity) overflow to Lawrence Creek. This type of collection and direct discharge of stormwater to adjacent waterways is very common along Montauk Highway throughout the Great Cove watershed; thus efforts to provide water quality treatment prior to discharge would assist in removal of common pollutants such as sediment, heavy metals and hydrocarbons. Montauk Highway in this area has many constraints, including limited road right of way, the presence of various subsurface utilities and a network of existing stormwater infrastructure, and minimal separation distance to groundwater. Given these constraints, a water treatment structure is proposed to be installed in-line with the existing stormwater infrastructure. The structure would require a high flow by-pass to ensure backup of the system and flooding could not occur during larger storm events or in the event that the structure is clogged/requires maintenance. As noted by the Details, there are two types of water quality treatment structures that may be considered. A simple baffle system collects sediment, floatables and hydrocarbons carried in stormwater runoff. Detail 2 is a water quality structure that includes filter media designed to additionally remove organics and nutrients. These structures require the establishment and implementation of a regular maintenance schedule to ensure proper function and long term water quality treatment.

4.2.3 Project 3: Town Housing Project (Penataquit Creek)

As noted on the Drainage Infrastructure Map for Project 3, a series of outfalls line Penataquit Creek between the Long Island Rail Road (LIRR) tracks and Union Blvd. east of Lakeview Ave. This property is a Town-owned parcel improved with a multifamily housing project. Penataquit Creek traverses the housing project and the Creek is directed into culverts below the housing site's parking lots on the north and south sides of property. In the central portion of the housing project, the Creek side slopes are stabilized with small rip rap, and lawn meets the Creek's edge in the majority of the site. Area drains collect stormwater within the existing lawn areas, which is then discharged directly to the outfalls located along Penataquit Creek. Overland flow of stormwater was also observed to be directed to the Town housing project's drainage system from a portion of Lakeview Ave. and an existing salvage yard located northwest of the property.

The proposed drainage improvements include:

- Replacement of the existing area drains throughout the housing project with leaching pools to allow for initial infiltration of stormwater prior to overflow to the Creek.
- Removal of the existing lawn fronting Penataquit Creek and creating a vegetated swale and buffer area to provide overland catchment of stormwater runoff, infiltration and biological uptake of stormwater runoff and increase shading of the Creek by establishing shade trees along the stream perimeter.
- Installation of a water quality treatment structure with high flow bypass at the existing catch basin in the northwest portion of the property (which is currently receiving off site stormwater runoff). As described above, this structure could either be a baffle system (type 1), or a system that includes filter media to address additional pollutants of concern.
- It is noted that overland flow of stormwater was observed from the adjacent salvage/storage yard to the northwest and stormwater outfalls to the Creek were observed from an existing contractor yard and parking lot located on the east and west sides of Creek (along the southern portion of the Town owned land).

No dry weather flows were observed from these outfalls; however these outfalls may be considered illicit discharges and should be removed. Any building or site plan applications for these adjacent parcels should require removal of these outfalls and the installation of appropriate drainage.

4.2.4 Project 4: Mechanicville Road Parking Area (Watchogue Creek)

Watchogue Creek runs through the Bay Shore business and commercial districts, with land uses dominated by approximately 43% commercial property and 29% high density residential properties. There are extensive parking areas and other impervious surfaces surrounding the Creek, and portions of the Creek are diverted through subsurface culverts below the Main St. business area. A large Town-owned parking area is located north of the central business district and south of Mechanicsville Road. Watchogue Creek daylights on the north side of this parking area, and a narrow fridge of vegetation exists along the stream bank at this location. The area immediately to the west of the stream is an existing lawn area. Stormwater generated from the municipal parking lot is directed into a grate in the parking lot which discharges directly to Watchogue Creek as it passes in the culvert below the parking area. Stormwater improvements proposed in this location include:

- Removal of the existing direct discharge to Watchogue Creek via the grated inlet in the parking area.
- Installation of subsurface leaching chambers or galleys in the central portion of the parking lot to provide for subsurface infiltration of stormwater. A portion of the parking lot area would need to be regraded to provide new low points to collect stormwater and divert it into the proposal linear infiltration system. An overflow from the linear collection system would be provided to Watchogue Creek for larger storm events.
- Installation of a biorention area in the existing lawn area adjacent to the west of the Creek. Stormwater runoff presently directed to the Creek from Mechanicsville Road and Smith St. would be directed to the biorention area for filtration prior to overflow to the Creek

4.2.5 Project 5: Gibson St. Parking Area (Watchogue Creek)

The Gibson St. parking area is a Town-owned parcel located adjacent to the west Watchogue Creek where the Creek daylights south of the Bay Shore business district. The Town recently completed a bulkhead replacement and created a park area surrounding the bulkhead including benches and lighting improvements. Several large diameter outfalls discharge to Watchogue Creek at this location. Field observations and the Drainage Infrastructure Map indicate that stormwater runoff from the surrounding streets and improvements is conveyed and directly discharged to these outfalls. This parking area is relatively small in size and is used most intensely during summer months as overflow parking for the nearby ferries, with only limited use during winter months. The parking lot's size, location and use patterns make this parking area an ideal candidate for several small scale stormwater demonstration projects. The drainage improvements proposed in this location could be installed and monitored for performance and consideration for future larger scale installations. The stormwater demonstration projects could include:

- Installation of a narrow stormwater biorention area in an area of existing striping (not currently used for parking). Overland flow of stormwater from the parking area would be directed to this biorention area for filtration prior to overflow to the existing outfall.
- Installation of permeable or porous pavement in a portion or throughout the parking lot. This location is relatively close to the Town's 2nd Ave. highway yard, which would allow for regular monitoring of the porous pavement. As the lot is not regularly utilized during winter months, plowing and salt/sanding could be restricted or tested in a portion of the lot. Additionally, given the site's proximity to downtown Bay Shore and to the adjacent park area, signage discussing the innovative green infrastructure improvements at the site would be readily visible and could provide positive educational opportunities.

- Installation of a diversion manhole to redirect stormwater runoff from the roadway conveyance system to a stormwater treatment structure. If the site were improved as a demonstration site, this location would provide an ideal location for testing and monitoring a stormwater treatment structure with filter media. Water quality in the Creek has shown elevated levels of phosphorus, nitrogen, ammonia and bacteria; pollutants which require either biological filtration or use of alternative proprietary measures such as filter media.

4.2.6 Project 6: South Shore Mall (Penataquit Creek)

As described above and in Section 2.2.1.6, Penataquit Creek has shown very few signs of water quality improvement and in many cases its water quality has worsened since 1980. Elevated levels of bacteria, nitrogen, total phosphorus, and particularly sodium and chloride levels are extremely elevated. Both the Town and the South Shore Mall salt storage sites are in proximity to the Creek and appear to continue to impact water quality by salinizing fresh water streams, making them toxic to aquatic life. While the South Shore Mall is a privately owned property, Penataquit Creek runs directly below the mall parking lot in a 2,600 foot underground pipe. Drainage infrastructure within the east and a portion of the south sides of the mall parking area includes a series of grated inlets that discharge directly to Penataquit Creek. Water quality monitoring indicates that sodium presents a significant water quality problem, and frequently has been more than double the 20 mg/L NYS standard. Salt is stored in an uncovered mound in the northwest parking area of the mall during winter months. Additionally, salt applied to the parking area is washed directly into the Creek via the existing grated inlets to the subsurface pipe. Improvements are necessary to both the salt storage practices and drainage infrastructure on the property. Recommendations include:

- Establish a formalized and covered salt storage area with an elevated impervious floor to prevent runoff from entering the pile. Locate store pile away from existing drainage inlets and Penataquit Creek.
- Establish linear biorention areas at each existing drainage inlet which directly discharges to the Penataquit Creek culvert (along the eastern portion of the parking lot). The existing drainage inlets would be raised and biorention area planted around each inlet to allow for

Source: http://nemo.uconn.edu/tools/stormwater/parking_lots.htm ponding/evapotranspiration, biological uptake and filtration prior to overflow into the culvert.

- Add smaller scale tree islands within the existing parking area and rain gardens to existing impervious plaza areas to increase subsurface infiltration of stormwater, disconnect rooftop runoff from the existing drainage conveyance system and reduce heat island effects. In order to ameliorate on-site soil limitations, retain moisture and foster rapid plant growth, use of CU-Structural Soil™, CU-Soil™ or similar treatment is recommended for all trees within tree pits and landscape islands in parking areas.
- Consider use of porous pavement in overflow parking areas, particularly in the eastern portion of the property, to reduce stormwater runoff, provide infiltration of stormwater runoff and reduce the need for winter salt applications within the parking area.
- Provide signage discussing the innovative green infrastructure improvements at the site, as such improvements will be readily visible and could provide positive educational opportunities.
- Inspect existing on site recharge basins, remove accumulated sediment and plant supplemental vegetation as necessary to ensure dense vegetation within the basins.
- Provide training for salt application and storage best management practices. Reduce use of chloride-containing road deicers and consider establishment of an anti-icing program (pre-wetting roads with de-icers prior to icing events) similar to the Town's program. Liquid magnesium chloride, liquid calcium chloride or salt water can be sprayed on the parking area before snow starts falling to prevent precipitation from forming an icy bond with the pavement. Pre-wetting also reduces the amount of salt spread during a storm.

4.2.7 Project 7: 2nd Ave. Highway Yard

As described above, water quality within Penataquit Creek has been impacted from a variety of pollutants carried in stormwater runoff from adjacent land uses. The 2nd Ave. Highway Yard is located between Harrison Ave. and 2nd Ave., just west of Penataquit Creek. The yard is used for highway vehicle storage and maintenance, and includes an area on the southeast corner of the site where street sweepers and maintenance vehicles are washed. The existing drainage system within the Highway Yard consists of a series of catch basin inlets which collect stormwater, which is then conveyed to an outfall directly to Penataquit Creek. The Town retrofitted the catch basins within the parking lot area with catch basins inserts several years ago. Site observations described in Section 4.1 note that catch basins were filled with sediment and sediment was accumulated throughout the parking lot, particularly in the southeast corner of the yard in the vicinity of the truck washing area and along the eastern portion of the parking lot. The Town also operates a salt storage yard opposite the

Highway Yard on the west side of 2nd Ave. Two covered salt storage structures are located in the western portion of the parking lot and a fueling station is located in the southeast portion of the property, near the site access. Field observations of existing drainage inlets within this parking lot and on the adjacent street did not find evidence of a positive overflow connection to the Highway Yard drainage system or direct discharge to the Creek. A drainage inlet is located immediately adjacent to the fueling station. The following recommendations for drainage/good house keeping improvements are provided:

- Retain and establish a regular monitoring and maintenance schedule for existing catch basin inserts to ensure proper functioning.
- Install leaching pools to intercept stormwater from the existing positive overflow to provide for infiltration of stormwater and reduce runoff directed to Penataquit Creek.
- Provide canopy for the existing fuel pump at the salt storage yard and install water treatment structure or catch basin insert at the existing inlet adjacent to the fueling pump.
- Provide a truck washing area with independent collection and recycling of waste water (do not allow for overflow to existing drainage system in parking area).
- Establish perimeter barriers for stockpile areas to avoid "creep" of stockpiles and spread of sediment within parking areas.
- Establish regular maintenance schedule for collection and proper disposal of sediment within parking lot areas.

4.2.8 Project 8: Maple Ave. Parking Area (Watchogue Creek)

The Maple Avenue Parking Area is located at the terminus of Maple Avenue in the vicinity of the Fire Island ferry terminals. The parking area is surrounded on three sides with bulkhead and fronts on Watchogue Creek on the west and Penataquit Creek on the east where the Creeks meet the Great South Bay. The parking area and bulkhead are aged and little drainage infrastructure exists within the parking lot area as the parking lot is crowned to drain stormwater runoff to the surrounding waterway. Several outfalls through the bulkhead also directly drain runoff to the adjacent waters. A pump station is located in the northeast corner of the parking area that pumps stormwater from the end of the roadway to an outfall through the bulkhead in the northeast corner of the parking lot. The pump station was installed to alleviate reoccurring flooding in the roadway when gravity flow

of stormwater to the outfall in the northeastern portion of the parking lot is not possible due to the low lying nature of the surrounding area, tidal fluctuation, and high groundwater conditions.

The bulkhead is in need of replacement and represents an opportunity to provide proper drainage and removal of direct stormwater discharges. The top of the bulkhead elevation should be raised and the parking lot re-graded to direct stormwater to newly established low points and drainage inlets within the parking area. Stormwater once collected should be directed to a water quality treatment structure designed with a high flow bypass to prevent flooding during large storm events.

4.2.9 Project 9: Oakwood Blvd. @ Awixa Creek

Oakwood Blvd. crosses over Awixa Creek just northeast of a multifamily housing development and the Home Depot/Shop Rite shopping center in Bay Shore. Oakwood Blvd. has been made one way in this location by striping out one lane of the existing roadway. Stormwater runoff from Oakwood Blvd. and contributing areas from St. Louis Ave. is collected in roadside catch basins that discharge directly to Awixa Creek. Recommended drainage improvements include redirecting stormwater from the direct outfalls at the road's crossing with Awixa Creek to a newly installed biorention area proposed within a small, Town-owned parcel on the south side of Oakwood Blvd. If there is certainty that the street will remain one way, the existing striped out pavement on the north side of Oakwood Blvd. also presents an opportunity to remove unused pavement and establish a vegetated buffer and stormwater collection area adjacent to the stream.

4.2.10 Project 10: Saxon Cul-de-Sac

This stormwater improvement project represents another common condition of large diameter cul-de-sac roadways that terminate in close proximity to surface water. Many of these cul-de-sacs have unused pavement area and limited drainage infrastructure, thereby allowing overland conveyances or direct outfalls of stormwater to the adjacent surface water. It is recommended the paved center portion of cul-de-sacs with radii of 60 feet or more be evaluated for conversion to vegetated depressions for use in the storage/treatment of stormwater runoff. Breaks in the curb around the central island should be provided to allow for overland flow of stormwater into the central vegetated depression, or stormwater could be piped to the central island area from existing catch basins inlets. Each cul-de-sac would need to be evaluated to ensure adequate turning radii are available for emergency vehicles. In the specific case of the South Saxon Ave. cul-de-sac, the cul-de-sac is slightly oblong in shape and a central island of maintained turf exists. This existing island of lawn could be excavated and replanted with hardy, native species.

Given the oblong configuration of this cul-de-sac, additional pavement is estimated to be necessary on the south side to improve the turning radius for larger vehicles. Once the capacity of the central depression is reached, stormwater could either overflow to the existing outfall located on the south side of the roadway, or a second vegetated depression could be pursued on the south side of the roadway to provide additional collection and recharge of stormwater prior to overflow to the outfall.

4.2.11 Project 11: Orowoc Road Ends (Orowoc Creek)

West of Commack Road and east of Orowoc Creek there are medium density residential neighborhoods where no street drainage currently exists. The subdivisions were constructed such that stormwater runoff is directed from the individual lots to the street, and the streets are pitched towards Orowoc Creek. Stormwater runoff flows towards the cul-de-sacs at the western end of the street and a sluiceway is provided at the western end of the cul-de-sac that allows direct discharges of stormwater to the Creek. This condition occurs in other areas of the Town, so the following recommended drainage improvements could be applied in similar neighborhoods:

- Install leaching pools to intercept stormwater in suitable upland locations within the neighborhood to reduce the amount of runoff directed to the Creek and provide for infiltration of stormwater closer to the source.
- County owned land exists at the western end of several of the cul-de-sacs (on the east side of the Creek) that is of sufficient size to provide biorention areas suitable for water quality treatment of stormwater prior to overflow into Orowoc Creek. Note that wetlands delineation/review by the NYSDEC and discussions with Suffolk County would be necessary prior to the installation of these biorention areas.
- Similar to Project #10 described above, several of these cul-de-sacs have areas of unused pavement that could be converted to landscaped depressions for stormwater collection and treatment. Evaluation of the adequacy of turning radii and emergency vehicle access would need to be completed to determine if such conversions of pavement to landscaped area would be feasible.

4.2.12 Project 12: Commack Road @ Orowoc Creek

Traveling north/northwest on Commack Road just north of the underpass of Sunrise Highway, Commack Road crosses over Orowoc Creek. Stormwater runoff from Commack Road east and west of this location is conveyed via overland flow, and by a drainage outfall directly into Orowoc Creek. The banks of the Creek, particularly on the south side of Commack Road were observed to be eroding from overland flow of stormwater from Commack Road. Recommended drainage improvements include removing the existing outfall on the north side of Commack Road and redirecting stormwater to a drainage manhole that would overflow to a newly installed biorention area proposed within the Town-owned parcel west of Orowoc Creek. This area was inspected to determine the proximity of wetlands to the roadway, and an area of upland suitable for installation of a biorention area was identified. Additionally, a new drainage inlet is recommended on the south side of Commack Road to intercept stormwater that is currently impacting the banks of Orowoc Creek. This drainage inlet would also be connected to the proposed manhole and biorention area overflow.

4.2.13 Project 13: Moffit Blvd. @ Orowoc Creek

Similar to Project #12, Moffit Blvd. also crosses over Orowoc Creek, east of Grant Avenue. There is no drainage infrastructure on Moffit Blvd. from the Orowoc Creek crossing east to Grant Avenue, with the exception of two inlets at the crossing of Orowoc Creek that directly discharge to the Creek. The depth to groundwater in this area is minimal. Drainage improvement recommendations include:

- Install low profile leaching systems to intercept stormwater from Moffit Blvd. east and west of the Creek. Such systems would provide infiltration of stormwater and reduce the quantity of stormwater currently directly discharging to the Creek.
- The County owned parcels on the north side of Moffit Blvd. should be investigated to determine the feasibility of installing a biorention area immediately adjacent to the roadway. Wetlands associated with Orowoc Creek are located throughout these parcels; however discussions with the NYSDEC could be pursued to determine if a biorention area would be permissible within upland areas of marginal vegetation adjacent to the roadway.

4.2.14 Project 14: Fischer Park (Champlin Creek)

Fischer Park is located adjacent to the east of Champlin Creek between Fischer Avenue and Beaver Dam Road. The park has a large area of maintained turf with a baseball field, basketball court, sand playground area and a minimal buffer of natural vegetation along Champlin Creek. Both Beaver Dam Road and Fischer Avenue cross over Champlin Creek and several outfalls direct stormwater from the streets directly to the Creek. Reducing the drainage contributing area (and therefore the quantity of stormwater overflow) to these existing outfalls is recommended. This can be accomplished by intercepting stormwater from adjacent roadways which drain toward the Creek and providing either leaching pools or low profile leaching systems (in areas where there is minimal depth to groundwater) to recharge stormwater. Low profile drainage systems are thought to be necessary within the park given the minimal depth to groundwater; however, these systems can be completing covered and reseeded so as not to interfere with regular park use.

4.2.15 Project 15: Town DPW Yard @ Champlin Creek

The Town DPW Yard is located on the west side of Carleton Avenue and east side of Champlin Creek. The facility has vehicle storage, material storage and an uncovered salt storage pile and brine preparation area on the west side of the yard. Much of the yard is unpaved and significant stock piles of various materials (sand, gravel, recycled concrete, etc.) are located throughout the yard. The uncovered salt storage areas is of immediate concern as this area is in close proximity to Champlin Creek and the pile is exposed to the elements allowing for uncontrolled stormwater runoff toward the Creek. The following recommendations for drainage/good house keeping improvements are provided:

- Relocate and provide covered storage of the salt pile as far as possible from Champlin Creek. Two options have been provided on the conceptual drainage improvement plan as the Town has considered reducing the size of the yard to allow for recreational facilities on the eastern half of the property. The salt storage dome should be placed on an impervious pad with a rolled curb or similar method of containment.
- Install leaching pools to intercept stormwater from the western access road and from within the paved portion of the yard (used for vehicle storage). Inlet filters or stormwater treatment structures should be considered in these areas to provide removal of oils and potential pollutants.

- Establish perimeter barriers for stockpile areas to avoid “creep” of stockpiles and spread of sediment within parking areas.
- Establish regular maintenance schedule for collection and proper disposal of sediment within parking lot areas.

4.2.16 Project 16: Brookwood Hall Park (Champlin Creek)

As with many areas along Montauk Highway, stormwater is directly discharged to Champlin Creek as the roadway crosses over Champlin Creek south of Brookwood Hall Park. The drainage contributing area to this outfall includes areas of higher elevation east and west of the culvert over Champlin Creek. Reducing the drainage contributing area (and therefore the quantity of stormwater overflow) to this direct outfall is recommended. Drainage improvement recommendations include:

- Install low profile leaching systems to intercept stormwater from Montauk Highway west of the Park. Such systems would provide infiltration of stormwater and would reduce the quantity of stormwater currently directly discharging to the Creek.
- Provide drainage inlets to intercept stormwater along Montauk Highway east of the culvert over Champlin Creek and direct this runoff to a drainage depression with a vegetated settling basin in the southeast corner of Brookwood Hall Park. The drainage depression would provide for filtering and recharge of stormwater, and would provide an opportunity for public educational signage regarding methods for water quality treatment of stormwater runoff.

SECTION 5

IMPLEMENTATION

5.0 IMPLEMENTATION STRATEGY

The Great Cove Watershed Management Plan has been designed to improve Great Cove's water quality by promoting best management practices for future development actions and routine municipal maintenance activities, education, environmental stewardship, and improvements in stormwater collection and treatment. Great Cove is part of the extensive South Shore Estuary Reserve (SSER) ecosystem and has been identified by SSER's Comprehensive Management Plan (CMP) as a major contributor of non-point source pollutants. Despite great progress in controlling point sources, water quality problems remain. Stormwater from urban, sub-urban and non-urban land areas have been identified as major contributors to water quality impairment by the U.S. Environmental Protection Agency (EPA). These non-point sources include runoff from roads and other impervious surfaces; animal waste from wildlife and pets; fertilizers from lawns; and atmospheric deposition of pollutants. By implementing the pollution preventative and corrective actions outlined in the WMP for general best management practices, public education and outreach, stormwater improvement strategies (with 16 specific target projects identified) and priority actions, steps can be taken to improve water quality, restore habitat, reduce water quality impairments to shellfish and other aquatic life, and allow for continued recreational opportunities in Great Cove and the Great South Bay.

5.1 Implementation Actions According to Governmental Jurisdiction

The following implementation strategy is meant to address the methods and means by which the Great Cove WMP will implement the projects and actions outlined in **Sections 3.0 and 4.0** above. This Section addresses different aspects of implementation including governmental jurisdiction, priority of the actions and potential funding sources to aid the Town in implementing the recommended actions outline in **Section 3.0** (see **Table 5-1**). Specific corrective actions including the 16 drainage improvement projects are summarized in **Table 5-2**.

Implementation of the Great Cove Watershed Management Plan involves many agencies, levels of government, civic groups, and citizens. Inter-governmental coordination and cooperation between the Town, County, State, non-profits, and the community is important to the success of the Great Cove WMP. Groups such as: Suffolk County Cornell Cooperative Extension (CCE), NYSDEC, EPA, Sea Grant, and the Suffolk County Soil and Water Conservation District (SCSWCD) can also provide information on the development of educational, outreach and stewardship materials as well as educational materials at their disposal relating to subjects such as best management practices (BMP), integrated pest management (IPM), and erosion and sediment control (ESC). Opportunities for collective efforts are noted as applicable.

As funding for stormwater improvements is often limited, the recommendations are also ranged in terms of priority for initial implementation based on the project type, key areas of concern, potential water quality benefits and field observations (Priority 1: Year 1-2, Priority 2: Year 2-5, Priority 3: Year 5-10, and Priority 4: Year 10-20). Potential funding sources have been identified for each recommendation (see **Section 5.2, Table 5-3**, for a description of each funding source).

Table 5-1
IMPLEMENTATION STRATEGY MATRIX

ID No.	Recommendation	Implementation Strategy				
		Type of Action	Responsible Entity[1]	Priority Level	Funding Sources [2]	Comment
General Non-Point Source Control Measures						
3.1.1.1	Identify and control stormwater outfalls; stormwater detention projects	Capital Improvement	Town, SCDPW, DOT	1	C-4, D-1, D-3	See Table 5-2 for specific projects.
3.1.1.2	Develop low impact design (LID) practice incentives or requirements	Planning & Legislative Actions	Town	1	Town Action	Refer to EPA guidance documents for examples.
3.1.1.3	Reduce unnecessary pavement	Legislative Action, Capital Improvement	Town	2	C-1, C-4,	Code changes are necessary to encourage pavement reduction in site plan and subdivision applications. Additionally, the Town can review individual municipal improvement projects for potential pavement reductions.
3.1.1.4	Reduce pavement near surface water	Legislative Action, Capital Improvement	Town, SCDPW, DOT	1	C-1,C-4	Legislative needed to increase buffers adjacent to surface water
3.1.1.5	Contain stormwater on-site	Planning Action & Capital Improvement	Town	2	A-1, B-1, C-4, E-7	
3.1.1.6	Intercept stormwater at higher elevations	Planning Action & Capital Improvement	Town, SCDPW, DOT	1	C-4	
3.1.1.7	Promote biological stormwater treatment	Legislative Action, Capital Improvement	Town, SCDPW, DOT	1	A-1,B-1, D-1, C-4, E-1	See NYSDEC 2010 Stormwater Design Manual for specific measures and required design elements.
3.1.1.8	Monitor/clean catch basin inserts	Maintenance Action	Town, SCDPW, DOT	1	Town, County and State DPW Forces	
3.1.1.9	Expand vegetative buffers near waterways	Planning & Legislative Actions, Capital Improvement	Town	1	C-4, H-1, D-3	
3.1.1.10	Support continued ban on phosphorus containing products	Enforcement Action	Town, SCDHS	1	Town/County Forces	
Municipal Good Housekeeping						
3.1.2.1	Establish regular maintenance schedule for stormwater infrastructure	Maintenance Action	Town, SCDPW, DOT	1	E-1, E-2	
3.1.2.2	Education for DPW personnel on importance of proper maintenance	Education Action	Town, SCDPW, DOT	1	Town Forces	Partner with education programs available through CCE, Sea Grant, etc.
3.1.2.3	Reduce chloride deicers/use alternatives	Maintenance Action	Town, SCDPW, DOT	1	H-2	Refer to guidance in NYSDOT Environmental Procedures Manual.
3.1.2.4	Increase frequency of street sweeping	Maintenance Action	Town, SCDPW, DOT	2	Town Forces	

[1] Town of Islip (Town); Suffolk County (SC) Department of Public Works (SCDPW); New York State Dept. of Transportation (DOT); SC Dept. of Health Services (SCDHS); SC Dept. of Environment & Energy (SCDEE); SC Department of Planning (SCDP)
[2] See **Table 5-3** for Funding Sources Key.

ID No.	Recommendation	Implementation Strategy				
		Type of Action	Responsible Entity[1]	Priority Level	Funding Sources [2]	Comment
3.1.2.5	Inventory waterways for possible dredging	Planning & Maintenance Actions	Town	3	E-2	
3.1.2.6	Monitor recharge basins for effectiveness/routine maintenance	Maintenance Action	Town, SCDPW, DOT	2	E-2	
3.1.2.7	Inventory Town facilities for stormwater BMPs	Maintenance Action, Capital Improvement	Town	2	E-2, E-3	See Table 5-2 for specific actions.
3.1.2.8	Inventory Town facilities for toxic/hazardous BMPs	Maintenance Action, Capital Improvement	Town	2	E-2	See Table 5-2 for specific actions.
3.1.2.9	Evaluate need for corrective actions for former Awixa Creek Town Landfill	Planning Action	Town	3-4	C-4	Explore opportunities for restoration or remediation (if necessary) through public/private partnerships.
3.1.2.10	Coordinate with other agencies for facility BMPs	Maintenance Action, Capital Improvement	Town, SCDPW, DOT, Village of Brightwaters	3-4	E-2, E-3	
3.1.2.11	Train Town staff on facility good housekeeping	Education Action	Town, SCDPW, DOT	2	D-6, E-3	Partner with education programs available through CCE, Sea Grant, etc.
Natural Resource Protection and Enhancement						
3.1.3.1	Protect existing wetlands to preserve benefit/function	Planning & Legislative Actions	Town, NYSDEC	2-3	D-1, D-7, E-2, J-1	Review of legislative requirement for buffer retention and reestablishment
3.1.3.2	Retain and expand natural areas for wetland buffers & restore new wetland areas where possible	Legislative Action & Capital Improvement	Town, SCDEE	2-3	D-1, D-7, E-2, J-1	Identify key properties for acquisition
3.1.3.3	“Daylight” streams where possible for natural flow	Legislative Action & Capital Improvement	Town	2-3	C-4, E-1	Consider implementation of legislative requirements for stream day lighting/restoration for private redevelopment actions.
3.1.3.4	Control invasive species in wetland/upland areas	Maintenance Action	Town, SDCPW, DOT	3	D-4, H-1	
3.1.3.5	Establish disturbed areas with native ground cover	Maintenance Action	Town, SDCPW, DOT	1	C-4, E-1, J-2	Establish protocol for short term and long term restoration for private and municipal projects.
3.1.3.6	Remove barriers to fish passage	Capital Improvement	Town, NYSDEC	3	D-1, J-1, N-1	Address make shift bridge at Champlin Creek
Land Use & Regulatory Measures						
3.1.3.1	Ensure Town land use decisions consider watershed impacts/Review and modify Town Code to allow for and incentivize adoption of Stormwater Management BMPs	Planning & Legislative Actions	Town	1	E-2	
3.1.3.2	Ensure conformance of constructed facilities with past decisions	Enforcement Action	Town	2-3	Town Forces	
3.1.3.3	Limit fertilizer dependent vegetation	Legislative & Education Action	Town	2	H-1, H-2	Establish planning guidelines or ordinance to reduce fertilizer dependent vegetation in proximity to surface water. Include landscaping BMPs in educational materials to homeowners/businesses.
3.1.3.5	Encourage use of indigenous plants in landscaping	Legislative & Education Action	Town	2	H-2	
3.1.3.6	Encourage “pick-up-after-your-pet” practices	Enforcement & Education Action	Town, SC Parks	1	H-2	Provide signage and educational materials on pet waste, location and use of pump-out

ID No.	Recommendation	Implementation Strategy				
		Type of Action	Responsible Entity[1]	Priority Level	Funding Sources [2]	Comment
3.1.3.7	Monitor, enforce and facilitate proper use of marine pump-out facilities	Enforcement & Education Action	Town, SCDHS	2-3	H-2	facilities and waterfowl feeding. Partner with education programs available through CCE, Sea Grant, etc. Keep Islip Clean and local school organizations are ideal partners in disseminating educational materials.
3.1.3.8	Manage waterfowl populations through establishment of ordinance and control/preventive measures	Legislative, Maintenance & Education Action	Town, SC Parks	1	H-2, E-2	
3.1.3.9	Monitor atmospheric deposition to understand watershed impacts	Legislative	Town	3-4	E-2, H-2	
3.1.3.10	Acquire key parcels on a prioritized basis where feasible and beneficial	Planning & Legislative Actions	Town, SCDP, SCDEE	2-3	D-5, L-1, M-1	
3.1.3.11	Explore potential benefits of a TDR program to strategically shift density	Planning & Legislative Actions	Town, SCDP	2-3	D-6, E-2	
Wastewater Management						
3.1.5.1	Provide sewering for existing developed, unsewered areas (focusing on areas that currently exceed Article 6 densities)	Legislative Action & Capital Improvement	SCDHS	4	A-1, B-1, C-1, C-3, H-3, D-1, L-1	
3.1.5.2	Examine sewer main exfiltration and control identified losses	Planning Action & Capital Improvement	SCDHS	3-4	C-1, C-3,	
3.1.5.3	Examine "in-pipe" treatment technologies to reduce nitrogen concentrations prior to reaching STP	Planning Action & Capital Improvement	SCDHS	3-4	C-1, C-3, A-1, B-1, H-3, D-1	Monitor results of SCDHS on-going studies regarding improvements to STP and on-site alternative systems.
3.1.5.4	Explore innovative on-site systems for individual residential use	Planning Action	SCDHS, Town	3-4	A-1, C-1, D-1	
3.1.5.5	New STPs should consider potential impact on surface water	Planning Action & Capital Improvement	SCDHS, Town	1	C-2, D-6	
3.1.5.6	Control pre-existing ("Legacy") on-site sanitary systems	Legislative & Enforcement Actions	SCDHS, Town	2-3	A-1, B-1, c-4	Adopt legislation requiring maintenance of systems per NYSDEC MS4 requirements.
Industrial Facility Control						
3.1.6.1	Inspect, monitor, enforce & cleanup industry using/storing chemicals	Enforcement Actions	Town, SCDHS, NYSDEC	1	E-2	
3.1.6.2	Enforcement of NYSDEC SPDES Multi-Sector General Permit and remediate known source of contamination	Enforcement Actions	Town, SCDHS, NYSDEC	1	H-3, E-5, E-6, A-1, L-1	
3.1.6.3	Ensure tank registration and compliance for chemical control	Enforcement Actions	Town, SCDHS, NYSDEC	1	E-3	
3.1.6.4	Monitor remediation efforts of the former MGP	Enforcement Action	NYSDEC, NYS Dept. of Health	1	E-3	
Education and Outreach						
3.1.7.1	Disseminate educational information using Town resources, including materials prepared as part of this WMP	Education Action	Town	1	C-7, E--3	Team with non-profit organizations (Keep Islip Clean, CCE, local civic organizations, etc.) to prepare and disseminate educational materials and encourage public participation.
3.1.7.2	Install "pick-up-after-your-pet" dispensers at Town facilities	Maintenance Action	Town	1	C-7, E--3	
3.1.7.3	Promote expansion of volunteer monitoring programs in watershed (Adopt a Drain, water quality monitoring, etc.)	Education Action	Town		D-6	
Water Quality Monitoring						
3.1.8.1	Fill identified data gaps through expanded monitoring programs and coordinate with other government/institutional stakeholders	Planning Action	Town, SCDHS, NYSDEC	2-3	D-6, E-2	Utilize collective efforts of on-going water quality monitoring (SUNY Stony Brook, USGS, etc.)
3.1.8.2	Promote expanded volunteer monitoring throughout watershed	Planning Action	Town; SCDHS	2-3	C-7,	
3.1.8.3	Maintain comprehensive watershed monitoring map for coordination	Planning Action	Town; SCDHS	2-3	E-2	

ID No.	Recommendation	Implementation Strategy				
		Type of Action	Responsible Entity[1]	Priority Level	Funding Sources [2]	Comment
3.1.8.4	Monitor initiatives for numerical WQ standard and support monitoring	Planning Action	Town; SCDHS	2-3	E-2	
Enforcement						
3.1.9.1	Enforce Town code related to watershed protection	Enforcement Actions	Town	1	E-3	
3.1.9.2	Monitor/report other detrimental activities for agency enforcement	Enforcement Actions	Town	1	Town Force	
3.1.9.3	Town monitoring of erosion controls at active construction & require bonds for cleaning of Town roadways/drainage systems in event of impacts during construction	Enforcement Actions	Town	1	Town Force	

For the targeted corrective actions outlined in **Section 4.0, Table 5-2** provides an implementation summary including: governmental jurisdiction, priority of the actions, order of magnitude costs and potential funding sources to aid the Town in implementing the recommended actions. Priority of projects were established based on:

- Project type;
- Subwatershed water quality impairments;
- Potential benefits;
- Ownership of property;
- Existing conditions (proximity to wetlands, depth to groundwater, soil conditions, etc.);
- Feasibility and probable permitting requirements;
- Site access;
- Order-of-magnitude cost estimate; and
- Design feasibility.

Order-of-magnitude cost estimates were developed for each project based on unit costs from a combination of resources including regional and nationwide studies, engineer's best estimates, manufacturer's estimates, and line item cost estimation. Reported costs include estimated materials and installation costs for each project, but do not include engineering design and permitting (which typically ranges from five to ten percent of construction costs depending on the complexity of the design), maintenance or monitoring costs, which may be substantial for some projects (e.g., replacement of filter cartridges, sediment removal and disposal, etc.). The order-of-magnitude cost ranges are provided below and estimates.

Cost Identifier	Dollar Range ($)
A	Less than $20,000
B	$20,001 - $50,000
C	$50,001 - $100,000
D	$100,001 - $200,000
E	$200,001 - $300,000
F	$300,001 - $500,000
G	$500,001 - $1 Million
H	Greater than $1 Million

Table 5-2
CORRECTIVE ACTION IMPLEMENTATION STRATEGY MATRIX

ID No.	Corrective Action/Recommendation	Implementation Strategy					
		Type of Action	Responsible Entity	Priority Level	Cost Range[3]	Funding Sources[4]	Comment
Town Facilities Best Management Practices							
2nd Avenue, Bay Shore - Garage							
4.1.1.1	Monitoring and maintenance of catch basins	Maintenance Action	Town	1	A	Town Forces	
4.1.1.2	Establish regular maintenance schedule for catch basin inserts	Maintenance Action	Town	1	A	C-4, L-1, M-1	Routine maintenance of catch basin inserts is necessary to ensure proper function.
4.1.1.3	Install water quality treatment system to intercept stormwater from direct overflow	Capital Improvement	Town	1	D	C-1, C-2, C-4, D-1, D-6, E-1	
4.1.1.4	Provide a truck washing area/collection system	Capital Improvement	Town	2	B	C-4, L-1, M-1	Requires EPA injection well permit or SCDPW Industrial Waste Permit.
4.1.1.5	Establish perimeter barriers for stockpile areas to avoid “creep” of stockpiles	Maintenance Action	Town	1	A	Town Forces	
4.1.1.6	Sediment collection & disposal within parking lot	Maintenance Action	Town	1	A	Town Forces	

[3] A (Less than $20,000); B ($20,001 - $50,000); C ($50,001 - $100,000); D ($100,001 - $200,000); E ($200,001 - $300,000); F ($300,001 - $500,000); G ($500,001 - $1 Million); H (Greater than $1 Million).
[4] See **Table 5-3** for Funding Sources Key.

ID No.	Corrective Action/Recommendation	Implementation Strategy					
		Type of Action	Responsible Entity	Priority Level	Cost Range[3]	Funding Sources[4]	Comment
2nd Avenue, Bay Shore - Salt Storage Yard							
4.1.2.1	Install canopy for the existing fuel pump	Capital Improvement	Town	3-4	B	C-4, L-1, M-1	
4.1.2.2	Establish perimeter barriers for stockpile areas to avoid “creep” of stockpiles	Maintenance Action	Town	2	A	Town Forces	
4.1.2.3	Sweep parking lot to ensure road salt is properly contained	Maintenance Action	Town	1	A	Town Forces	
Animal Shelter, Town Impound Yard and Former Town Landfill, Bay Shore							
4.1.3.1	Ensure proper disposal of pet waste	Maintenance Action	Town	1	A	Town Forces	
Town Highway Garage Yard, Central Islip							
4.1.4.1	Relocate salt storage pile and provide covered salt dome/enclosure	Capital Improvement	Town	1	C-D	C-4, L-1, M-1	Costs of salt storage and fuel canopy range depending on material specifications of structures.
4.1.4.2	Install of drainage structures for storage area	Capital Improvement	Town	1	B	C-1, C-2, C-4, D-1, D-6, E-1	Routine maintenance of catch basin inserts is necessary to ensure proper function.
4.1.4.3	Provide a truck washing area/collection system	Capital Improvement	Town	2	B	C-4, L-1, M-1	Requires EPA injection well permit or SCDPW Industrial Waste Permit.
4.1.4.4	Install canopy for the existing fuel pump	Capital Improvement	Town	2	B	C-4, L-1, M-1	

ID No.	Corrective Action/Recommendation	Implementation Strategy					
		Type of Action	Responsible Entity	Priority Level	Cost Range[3]	Funding Sources[4]	Comment
4.1.4.5	Establish perimeter barriers for stockpile areas to avoid "creep" of stockpiles	Maintenance Action	Town	2	A	Town Forces	
4.1.4.6	Sweep parking lot to ensure road salt is properly contained	Maintenance Action	Town	1	A	Town Forces	
Islip Park Department Maintenance Yard, Central Islip							
4.1.5.1	Establish perimeter barriers for stockpile areas to avoid "creep" of stockpiles	Maintenance Action	Town	2	A	Town Forces	
Specific Drainage Improvement Projects							
4.2.1	Project 1: Archie Place (Trues Pond)	Capital Improvement	Town	2	C-D	C-1, C-2, C-4, D-1, D-6, E-7	Estimate range: $70,000 - $130,000. Cost range is dependent on selection of water quality treatment structure (baffle vs. filter system).
4.2.2	Project 2: Montauk Highway at Lawrence Creek (Lawrence Creek)	Capital Improvement	DOT	3	B-D	C-1, C-2, C-4, D-1, D-6, E-7, F-1A, F-1B, G-1, G-2	Estimate range: $45,000 - $130,000. Cost range is dependent on selection of water quality treatment structure (WQTS) (baffle vs. filter system).
4.2.3	Project 3: Town Housing Project (Penataquit Creek)	Capital Improvement	Town	4	D	C-1, C-2, C-4, D-1,D-2, D-6, E-7	Estimate range: $115,000 - $175,000. Cost range is dependent on selection of WQTS (baffle vs. filter system).

ID No.	Corrective Action/Recommendation	Implementation Strategy					
		Type of Action	Responsible Entity	Priority Level	Cost Range[3]	Funding Sources[4]	Comment
4.2.4	Project 4: Mechanicville Road Parking Area (Watchogue Creek)	Capital Improvement	Town	2	D	A-1, B-1, C-1, C-2, C-4, D-1, D-6	Estimate range: $130,000.
4.2.5	Project 5: Gibson Parking Area (Watchogue Creek)	Capital Improvement	Town	3	C-F	A-1, B-1, C-1, C-2, C-3, C-4, D-1, D-6, E-7	Estimate range: $54,000 - $113,000 for drainage improvements. Porous asphalt is estimated @ $216,000. Cost range for drainage improvements is dependent on selection of WQTS (baffle vs. filter system). Good opportunity for green infrastructure education signage.
4.2.6	Project 6: South Shore Mall (Penataquit Creek)	Planning Action, Capital Improvements	Private Owner	3	F-H	C-4	Estimate range: $307,000 for drainage improvements. Porous asphalt is estimated @ $840,000. Good opportunity for green infrastructure education signage.
4.2.7	Project 7: 2nd Ave. Highway Yard (Penataquit Creek)	Capital Improvement	Town	1-2	D-E	C-1, C-2, C-4, D-1, D-6, E-1	Estimate range: $102,000 - $182,000 for drainage only. Cost range is dependent on selection of water quality treatment structure (WQTS) (baffle vs. filter system). Estimate of $65,000 for truck wash area and fuel canopy.

ID No.	Corrective Action/Recommendation	Implementation Strategy					
		Type of Action	Responsible Entity	Priority Level	Cost Range[3]	Funding Sources[4]	Comment
4.2.8	Project 8: Maple Ave. Parking Area (Watchogue Creek)	Capital Improvement	Town	1-2	H	C-1, C-2, C-3, C-4, D-1, D-6, E-1, E-7, F-1B, F-1C, G-2, K-1, K-2	Estimate: $2.26 Million.
4.2.9	Project 9: Oakwood Blvd. (Awixa Creek)	Capital Improvement	Town	3	C	C-1, C-2, C-4, D-1, D-6, E-7	Estimate: $55,000.
4.2.10	Project 10: Saxon Cul-de-Sac (Awixa Creek/Great Cove)	Capital Improvement	Town	3	B	C-1, C-2, C-4, D-1, D-2, D-6, E-7	Estimate: $36,000.
4.2.11	Project 11: Orowoc Creek Road Ends (Orowoc Creek)	Capital Improvement	Town	2	B	C-1, C-2, C-4, D-1, D-2, D-6, E-7	Estimate range: $50,000 per street with drainage & biorention area. $30,000 per street with drainage only. Construction of biorention areas would require approval for use of County property.
4.2.12	Project 12: Commack Road (Orowoc Creek)	Capital Improvement	Town	3	C	C-1, C-2, C-4, D-1, D-6, E-7, F-1A, G-1, G-2	Estimate: $72,000.
4.2.13	Project 13: Moffit Blvd. (Orowoc Creek)	Capital Improvement	Town	4	C	C-1, C-2, C-4, D-1, D-6, E-1, E-2, E-7, J-1	Estimate: $75,000. Construction of biorention areas would require approval for use of County property.

ID No.	Corrective Action/Recommendation	Implementation Strategy					
		Type of Action	Responsible Entity	Priority Level	Cost Range[3]	Funding Sources[4]	Comment
4.2.14	Project 14: Fischer Park (Champlin Creek)	Capital Improvement	Town	2	E	C-1, C-2, C-4, D-1, D-6, E-7, G-1, G-2	Estimate: $202,000. Good opportunity for stream buffer education signage.
4.2.15	Project 15: Town DPW Yard (Champlin Creek)	Capital Improvement	Town	1	E-F	C-1, C-2, C-4, D-1, D-6, L-1, M-1	Estimate range: $46,000 for drainage only. Estimate range for truck wash area, fuel canopy and salt dome: $130,000 - $245,000 depending on material specifications for salt enclosure.
4.2.16	Project 16: Brookwood Hall Park (Champlin Creek)	Capital Improvement	DOT, Town	3	E	C-1, C-2, C-4, D-1, D-6	Estimate: $297,000. Good opportunity for green infrastructure education signage.

5.2 Potential Funding Sources

New York State and the federal government provide many opportunities to obtain government funding. The types of projects eligible for funding are wide-ranging. Each grant program has its own application periods and requirements, which can be obtained by accessing the websites of the sponsoring agencies. The grant programs (and the sponsoring agencies) listed in **Table 5-3** have been assembled as potential funding sources for the types of projects and recommendations noted in the Great Cove WMP. Note that this listing does not include private funding sources from foundations.

With each project recommendation listed, it is recommended that the appropriate Town officials contact agency representatives to discuss funding priorities and specific eligibility requirements. Most of the recommended projects may be funded under the Environmental Protection Agency's Clean Water Act amendments whose programs are administered in New York State mainly through the New York State Environmental Facilities Corporation. The program offers loans and grants for projects that rate high in overall State rankings. On an annual basis, the agency requests applications for projects to be included in the State's Intended Use Plan (IUP) which is the first step in the funding process. For drainage projects on Town roads or parking lots, the Town can dedicate all of or a portion of its annual funding under the New York State Transportation Consolidated Highway Improvement Program (CHIPS). Also included are the New York State Member Item Funding as well as Federal Legislative Grant funding. The Town should contact their New York State and federal representatives to access this funding.

Table 5-3

FUNDING SOURCES

ID No.	Funding Sources	Program	Eligible Activities
A	U.S Department of Housing & Urban Development	1. Community Development Block Grant (CDBG)	▪ Drainage, resurfacing, elimination of blight, in designated CD areas serving low and moderate income residents
B	New York State Office of Housing & Community Renewal	1. Community Development Block Grant (CDBG)	▪ Construct or improve publically owned infrastructure necessary to accommodate the creation, expansion or retention of businesses
C	New York State Environmental Facilities Corporation	Clean Water State Revolving Fund- 1. A. Green Innovation Grant Program 2. Loan Financing 3. Section 212- Point Source 4. Section 319- Non Point Source	▪ Water quality improvement projects- loans and grants for point source projects such as STPs and sewers and Non Point Source projects for stormwater management, land acquisition if related to preserving water quality- projects must be municipally owned-bio-retention, permeable surfaces. Provision for non-municipal projects. ▪ Low-interest loans- for green or non-green projects for projects described above/no interest loans for short term financing ▪ STPs Sewers- design & construction ▪ Stormwater management, structural & non-structural practices sediment, pesticide and fertilizer control, bio-retention, permeable surfaces. non-municipal non-point source, not-for-profit land acquisition, highway deicing material storage.
		5. Clean Vessel Assistance Program (CVAP) Construction Grant Program	▪ 75/25 federal funding for the purchase of pump-out boats up to $60,000 finding cap. 75/25 funding for stationary pump-outs purchase and installation.
		6. Facility Upgrade Grant Program	▪ 75/25 funding for improvements to pump-out boats and/or stationary pump-outs

ID No.	Funding Sources	Program	Eligible Activities
		7. Information and Education Grant Program	▪ 75/25 federal funding for education and promotion - $5,000 maximum funding
D	New York State Department of Environmental Conservation (NYSDEC)	1. Water Quality Improvement Project	▪ Municipal wastewater treatment ▪ Municipal separate storm sewer systems (MS4s) ▪ Nonagricultural nonpoint source abatement and control ▪ Aquatic habitat restoration ▪ Water quality management ▪ (Reimbursements up to 85% of project costs)
		2. Urban Forestry Grant Program	▪ 50/50 cost share for tree planting along streams
		3. Environmental Restoration Program	▪ Investigation and Cleanup Grants - must have a CBO in partnership with a municipality
		3. Terrestrial Invasive Species Eradication Grant Program	▪ 50/50 grant program to remove plants and animals as per NYS DEC guidelines
		5. Open Space Funding- Title 7	▪ Environmental important lands where development pressure exist or are causing pollution
		6. Section 106- Water Pollution Control	▪ Water quality planning & assessments, development of water quality standards, ambient monitoring, development of maximum daily loads, ground water and wetland protection, non-point source control activities, including non-point source controls assessment & management plans ▪ Green Infrastructure component: tree planting that addresses environmental issues of heat island effect, stormwater management Brownfield restoration design, combined sewer overflow (CSO) or energy demand production-50/50

ID No.	Funding Sources	Program	Eligible Activities
			matching grants.
E	U.S. Environmental Protection Agency (Note on EPA Water Quality Projects- QAPP-Quality Assurance Protection Plan must be EPA adopted at the time that application is submitted)	1. Targeted Watersheds Grants Program	▪ 75/25 federal funding for protecting and restoring water uses, forming partnerships using new technologies, market incentives and results-oriented strategies/capacity building grants are available. ▪ Drainage, resurfacing, permeable paving
		2. Surveys, Studies, Investigations, Demonstrations and Training Grants	▪ Planning, wetlands protection, coastal and estuarine planning treatment technologies. Examples: development of water protection guides for communities demonstration projects
		3. Assessment and Watershed Protection Program Grants	▪ Innovative water quality assessment and modeling techniques, training handbooks
		3. Pesticide Environmental Stewardship Regional Grants	▪ Integrated pest management approaches that reduce the risks associated with pesticide use in non-agricultural settings
		5. Brownfield Training, Research & Technical Assistance	▪ Education projects ▪ 75/25 funding for site assessments, clean up plan and community involvement
		6. Brownfield Assessment and Clean-Ups	▪ 80/20 grants and revolving loan for CERLA qualified sites
		7. Section 320- National Estuary Program	▪ Protection of water quality supplies, protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife and habitat restoration.

ID No.	Funding Sources	Program	Eligible Activities
F	FHWA administered by NYS DOT thru Suffolk County DPW-Federal Funding administered by NYS DOT / New York Metropolitan Planning Council (NYMTCC)	SAFETEA-LU 1A. Surface Transportation System (STS) 1B. Transportation Enhancements Program 1C. Ferry Boat Discretionary Program	▪ Road reconstruction and drainage/impervious surfaces stormwater outflow devices. Road must be designated on Federal Aid Urban system Maps ▪ Enhancements to the Transportation System-streetscapes, historic preservation, environmental improvements ▪ Construction of ferry terminal facilities
G	New York State Dept. of Transportation	1. Consolidated Highway Improvement Program (CHIPS) 2. Multi-Modal Program	▪ Drainage curb, sidewalks, permeable paving ▪ Drainage, curb, sidewalks, permeable paving
H	New York State Department of State (NYSDOS)	1. Local Waterfront Revitalization Program (LWRP) 2. Environmental Protection Funding (EPF) 3. Brownfield Opportunity Areas Program (with NYSDEC)	▪ Water Quality Improvement Projects are eligible if part of overall improvement project-planning & implementation e.g. storm drain inserts, various projects that protect harbors, education projects and studies. ▪ Identifying, planning and remediation/re-development of designated area
I	New York State Office of Parks, Recreation & Historic Preservation	1. Environmental Protection Fund	▪ Land acquisition for park purposes
J	National Fish and Wildlife Foundation	1. National Wetland Program Development Grants and Five-Star Restoration Training Grants 2. Native Plan Conservation Initiative	▪ Protect, manage and restore wetlands and streams by monitoring & assessment ▪ Volunteer wetland restoration & protection, and ▪ Wetland-specific water quality standards partnership with businesses, community & schools projects that benefit multiple species. ▪ Achieve a variety of habitat degradation/high priority

ID No.	Funding Sources	Program	Eligible Activities
			critical conservation need/demo projects with a high level of public involvement/leverage funding involving partnerships
K	Federal Emergency Management Agency (FEMA) thru NYS Division of Homeland Security & Emergency Services (DHSES) (formally NYS SEMO)	1. Flood Mitigation Assistance Program 2. Hazard Mitigation Assistance Program 3. Pre-Disaster Mitigation Program 4. Severe Repetitive Loss Program	▪ Various projects to prevent flooding and protecting public and private resources, e.g. road and property elevations, culverts, projects must have a positive benefit-cost ratio, 75/25 funding
L	Federal Legislative Grants-Earmarks	1. Various- thru Congressman and Senators	▪ All initiatives
M	NYS Member Item Funding	1. Various- thru State Senate and Assembly	▪ All initiatives
N	National Oceanic & Atmospheric Administration (NOAA)	1. American Rivers	▪ Fish Passage Projects

SECTION 6

REFERENCES

6.0 REFERENCES

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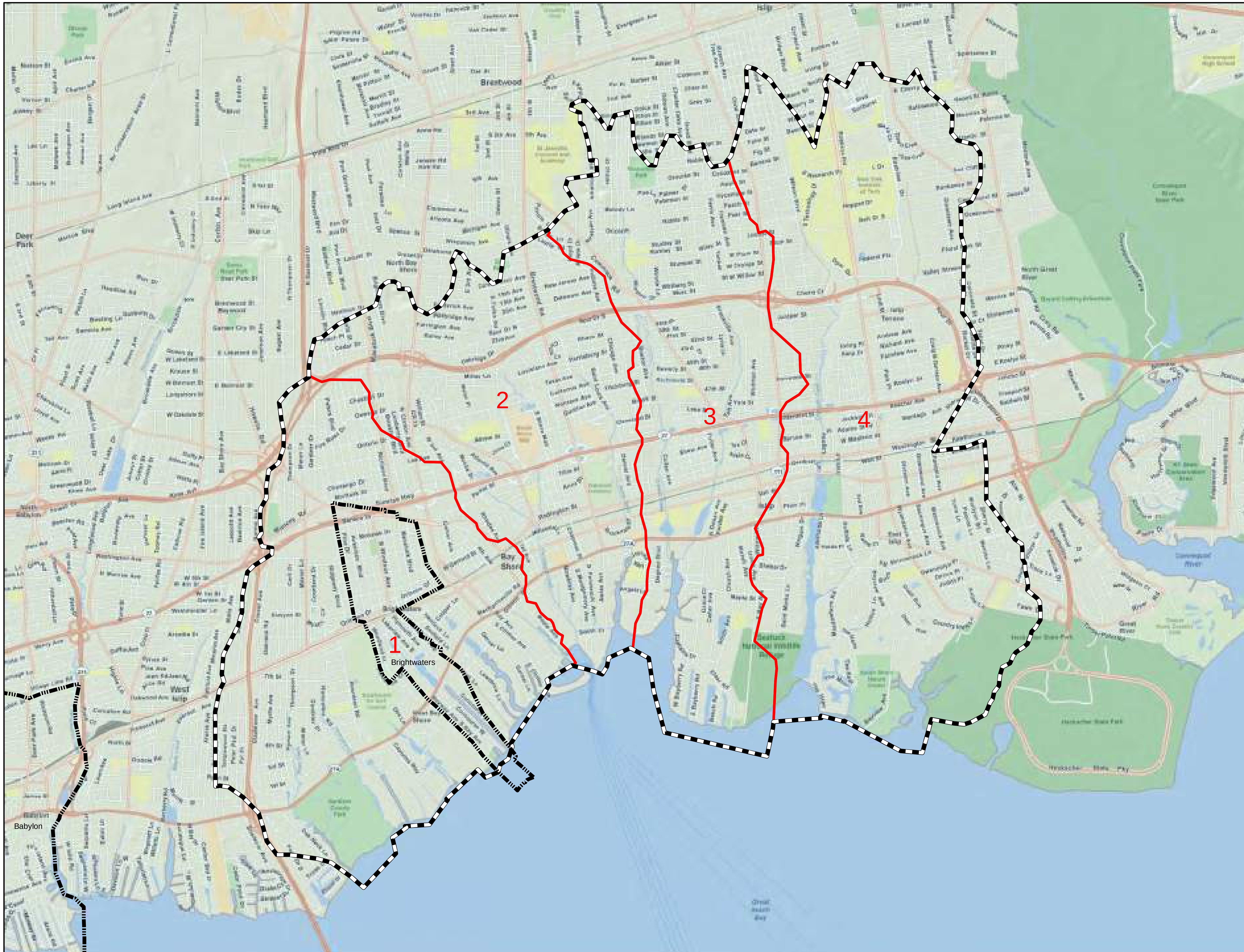
FIGURES



Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 1-1
LOCATION MAP

SOURCE: Town of Islip GIS; ESRI World Street Map
SOURCE DATE: February 2010

Legend

- Great Cove Overall Watershed Boundary
- Sub-Areas
- Village Boundary

1 inch = 4,000 feet

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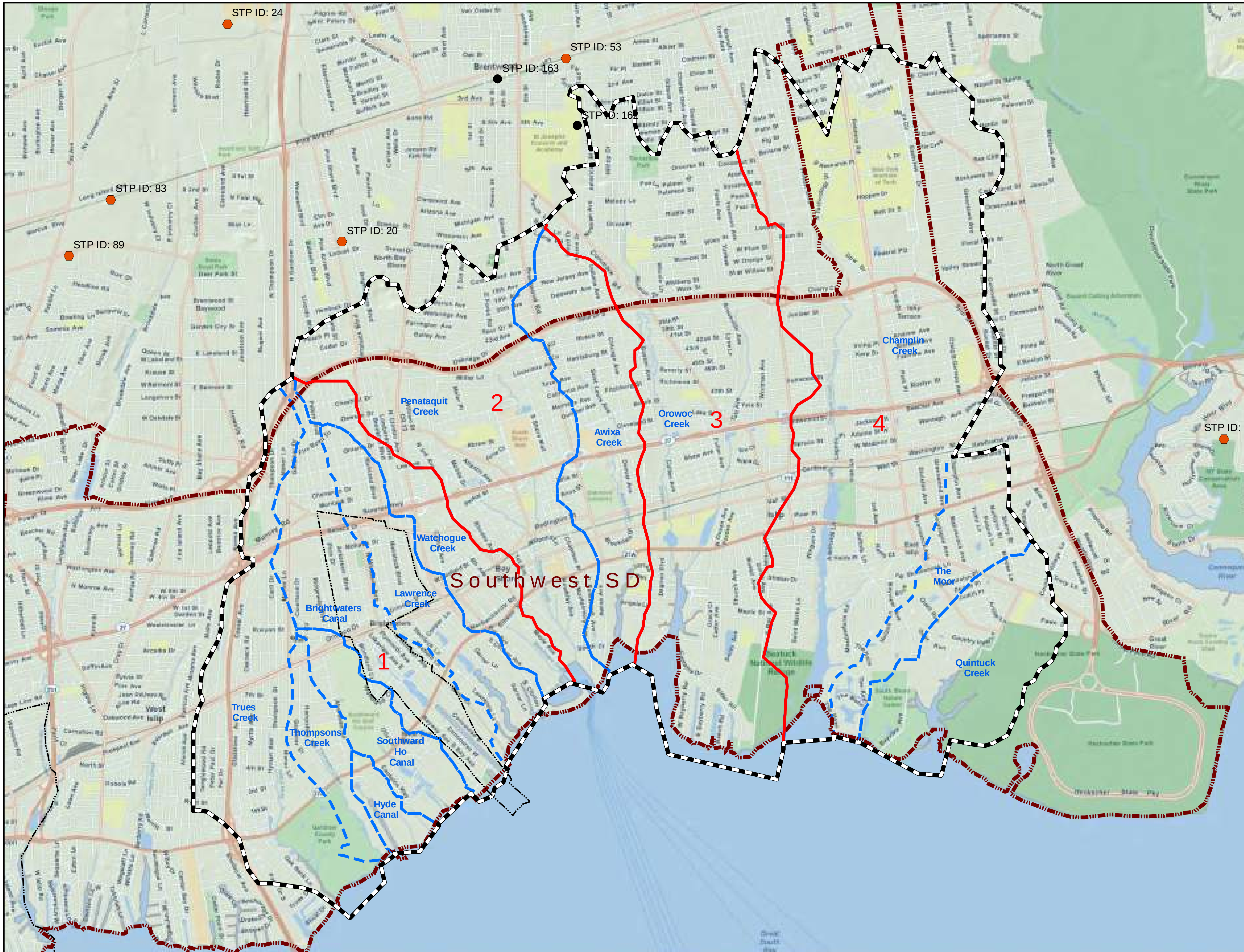

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 1-2
INDIVIDUAL WATERSHEDS AND SEWER DISTRICT MAP

SOURCE: Town of Islip GIS; ESRI World Street Map
SOURCE DATE: February 2010

Legend

- Great Cove Overall Watershed Boundary
- Village Boundary
- Sub-Areas
- Sewer District (SD)
- Individual Watershed Boundaries

Sewage Treatment Plants Outside SD

Discharge Type

- Cromaglass
- Groundwater

1 inch = 3,777 feet

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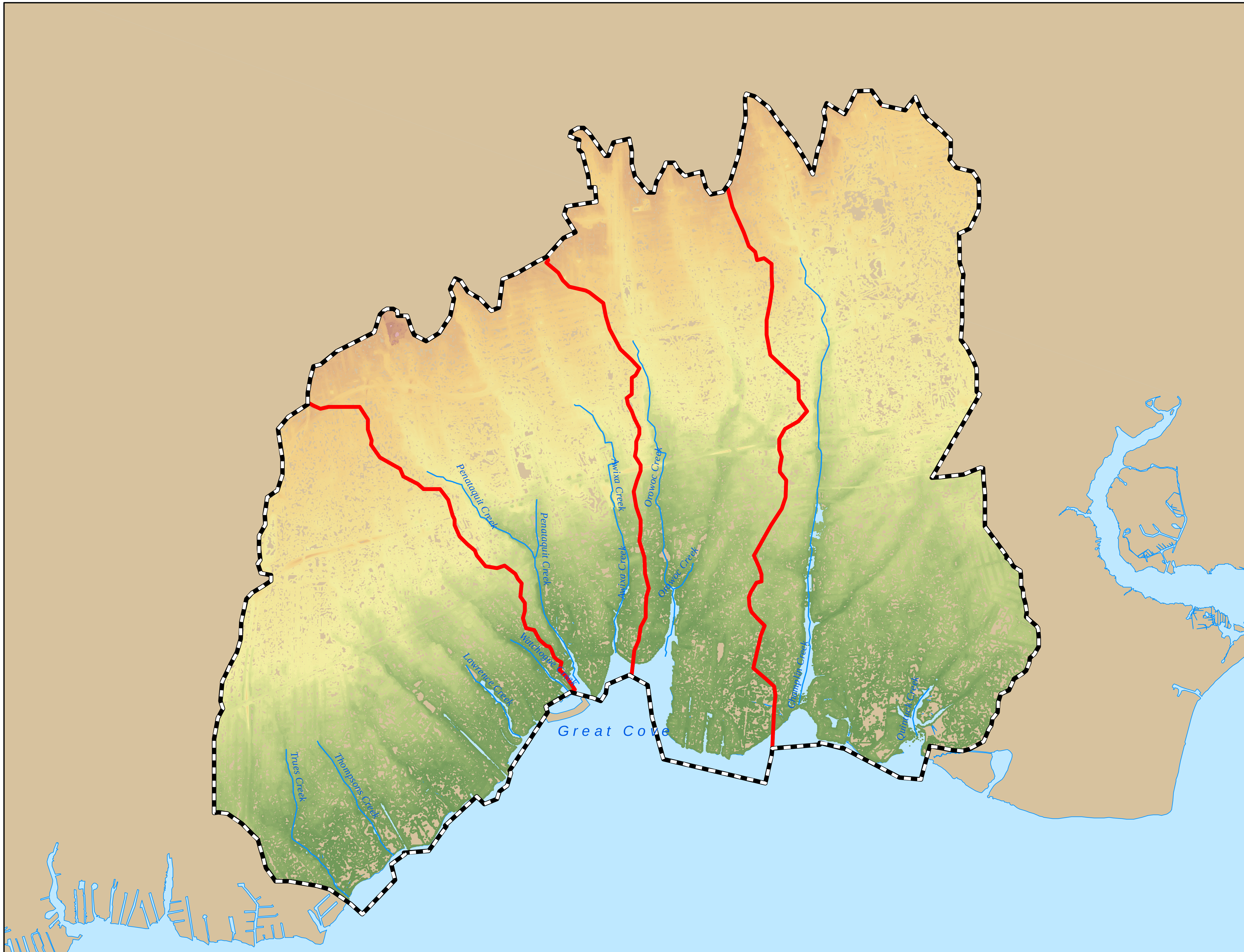

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 2-1
TOPOGRAPHY

SOURCE: Suffolk County LiDAR, 2007
SOURCE DATE: February 2010

Legend

- Great Cove Overall Watershed Boundary
- Sub-Areas
- Streams
- Elevation: Max 109' – Min 1'

1 inch = 4,000 feet

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GREAT COVE WATERSHED
MANAGEMENT PLAN

FIGURE 2-2
SOILS MAP

SOURCE: NYSGIS Clearinghouse; SSURGO Database; Town of Islip
SOURCE DATE: February 2010

Legend

- Great Cove Overall Watershed Boundary
- Sub-Areas
- Main Roads
- Streams

Soil Type

At	Fs	RdA
Bc	Gp	RdB
Bd	HaA	RhB
CpA	HaB	Su
CpC	Ma	Tm
CpE	Mu	Ur
CuB	PlA	W
CuC	PlB	Wd
De	PlC	We
Fd	Rc	

1 inch = 4,000 feet

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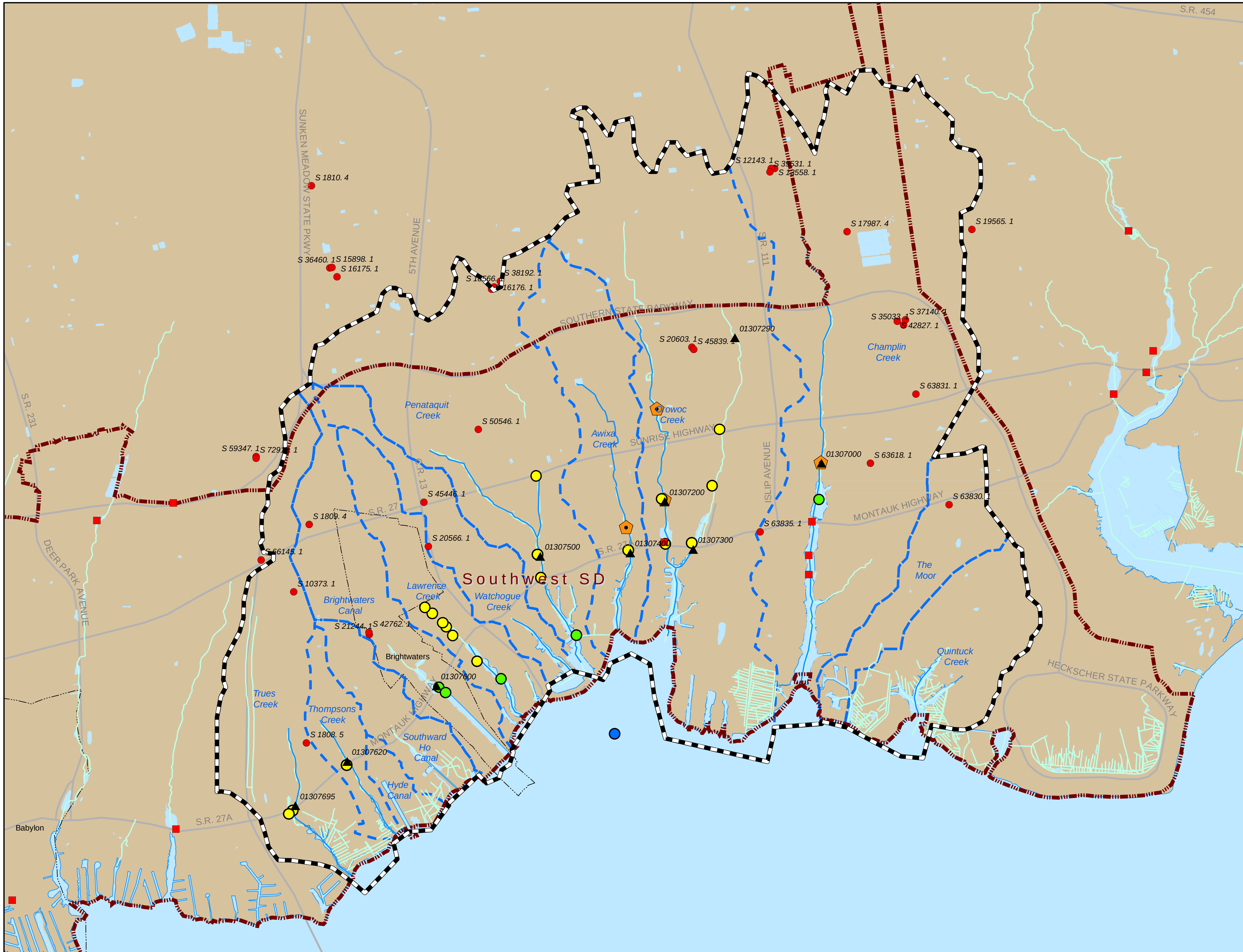
GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 2-3
WATER QUALITY MONITORING STATIONS

SOURCE: NYSGIS Clearinghouse; USGS; NYSDEC; SCDHS; LI Water Sentinels
SOURCE DATE: September 2010



Legend

- Great Cove Overall Watershed Boundary
- Individual Watershed Boundaries
- Village Boundary
- Sewer District
- Surface Water
- Streams
- Main Roads
- NYSDEC-Inventoried Dams
- SCDHS Stream Sites
- SCDHS Tidal Station
- LI Water Sentinels Stations
- NYSDEC RIBS Stations

USGS Monitoring Stations

- Groundwater
- Surface Water

1 inch = 4,000 feet

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GREAT COVE WATERSHED
MANAGEMENT PLAN

FIGURE 2-4
GROUNDWATER CONTRIBUTING AREA

SOURCE: Draft Comprehensive Water Resources Management Plan for Suffolk County (CDM, 2009)
SOURCE DATE: 2009

Legend

Great Cove Overall Watershed Boundary

Groundwater Contributing Area Time of Travel (Years)

- >25 - 50
- >10 - 25
- >5 - 10
- >2 - 5
- 0 - 2
- Water Body

1 inch = 4,000 feet

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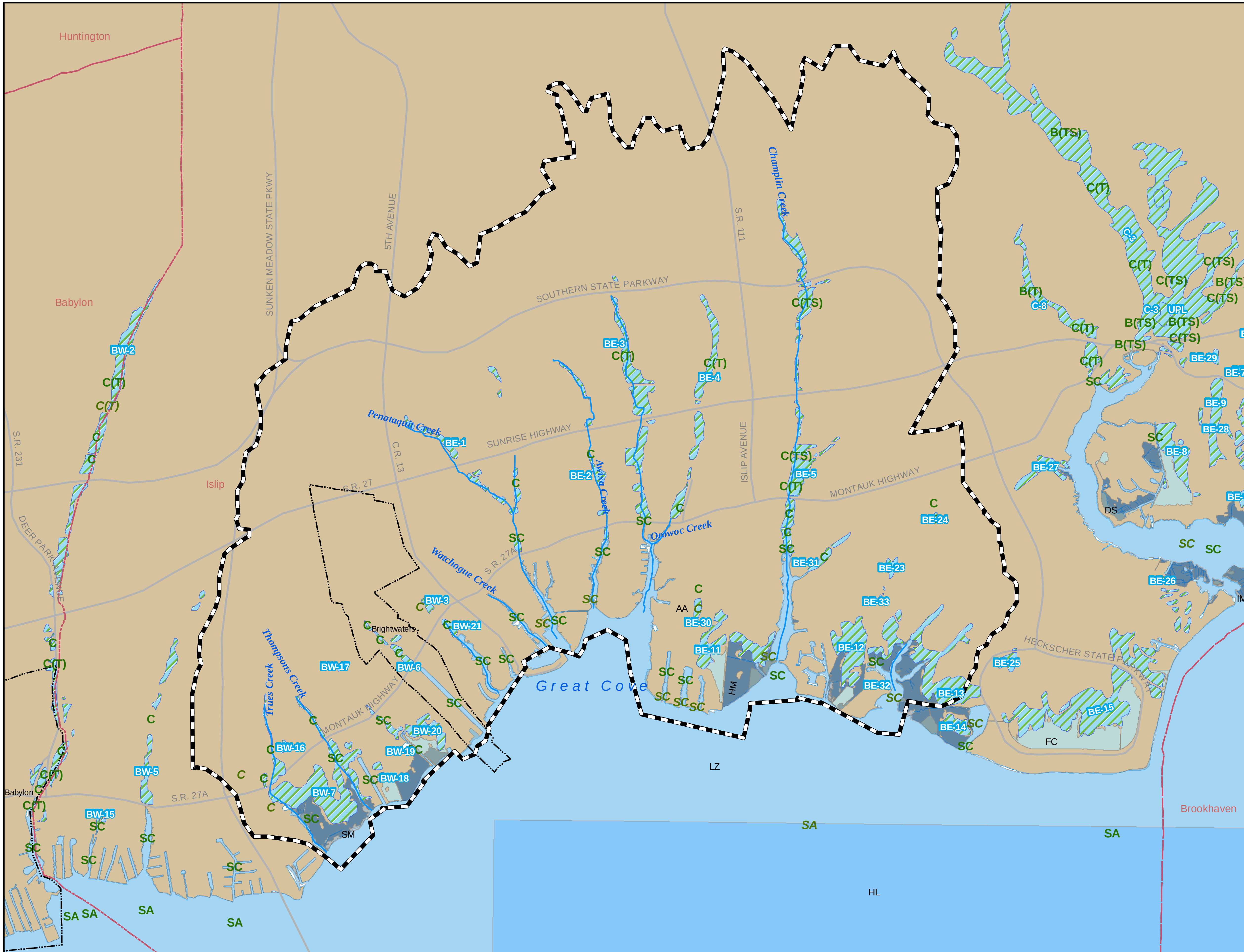

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 2-5
NYSDEC REGULATED WETLANDS

SOURCE: NYSGIS Clearinghouse; NYSDEC Freshwater and Tidal Wetlands Maps & Water Quality Class; SSER Tributaries
SOURCE DATE: April 2010

Legend

Great Cove Overall Watershed Boundary
Village Boundary
Town Boundary
Main Roads
Streams

NYSDEC Water Quality Class

NYSDEC Freshwater Wetlands
NYSDEC Tidal Wetlands
Tidal Wetlands Categories
LZ - Littoral Zone
SM - Coastal Shoals, Bars & Mudflats
HM - High Marsh
IM - Indertidal Marsh
FM - Fresh Marsh
DS - Dredged Spoil
FC - Formerly Connected
HL - Hole Area (No Data)

1 inch = 4,000 feet

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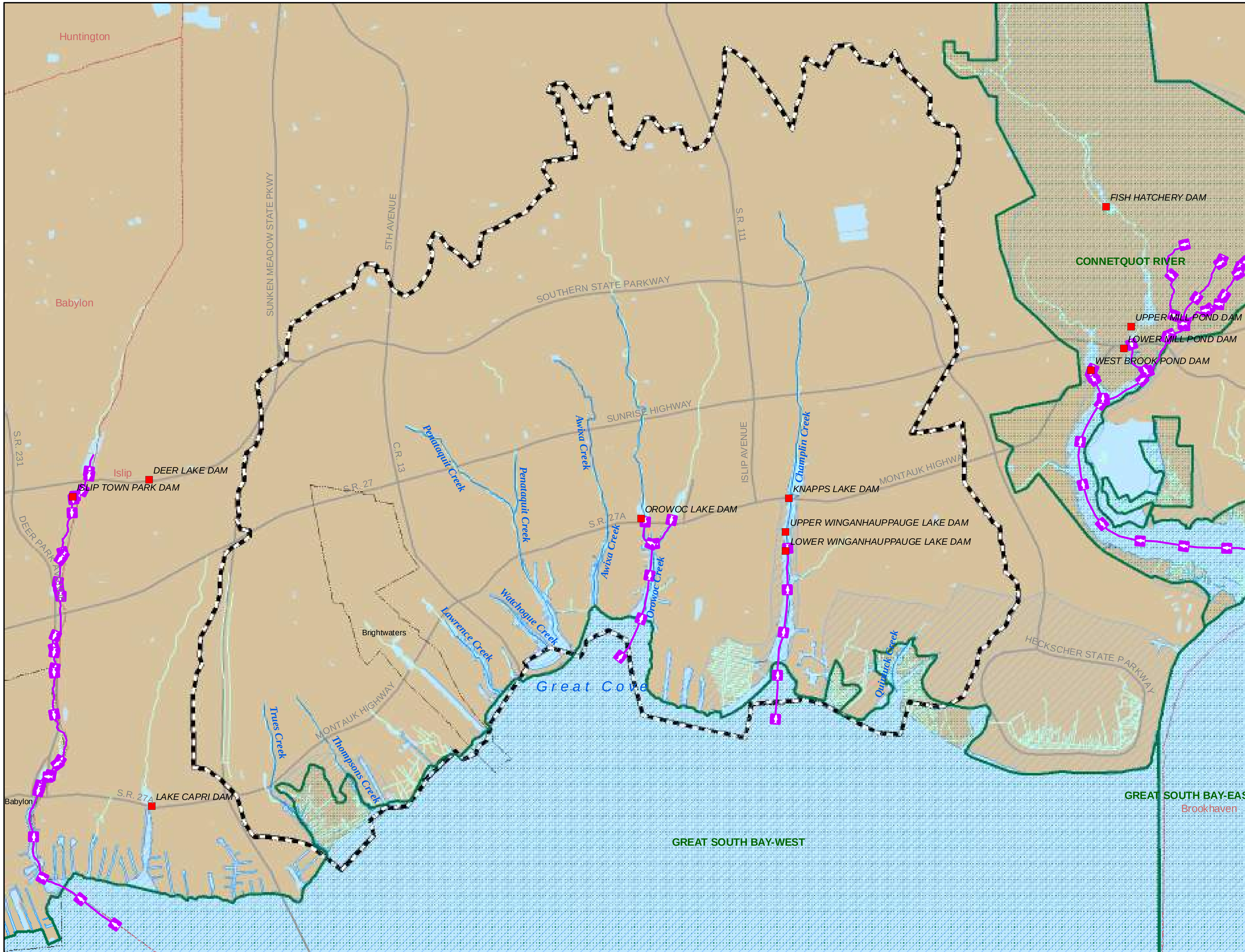
GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 2-6
RESOURCE MANAGEMENT AREAS

SOURCE: NYSGIS Clearinghouse; Town of Islip; SSER
SOURCE DATE: February 2010



Legend

- Great Cove Overall Watershed Boundary
- Town Boundary
- Village Boundary
- NYS Signficant Fish and Wildlife Habitat
- Waterfowl Focus Area (ACJV)
- NYSDEC-Inventoried Dams
- Historic Anadramous Fish Run
- Surface Water
- Streams (SSER)
- Main Roads

1 inch = 4,000 feet

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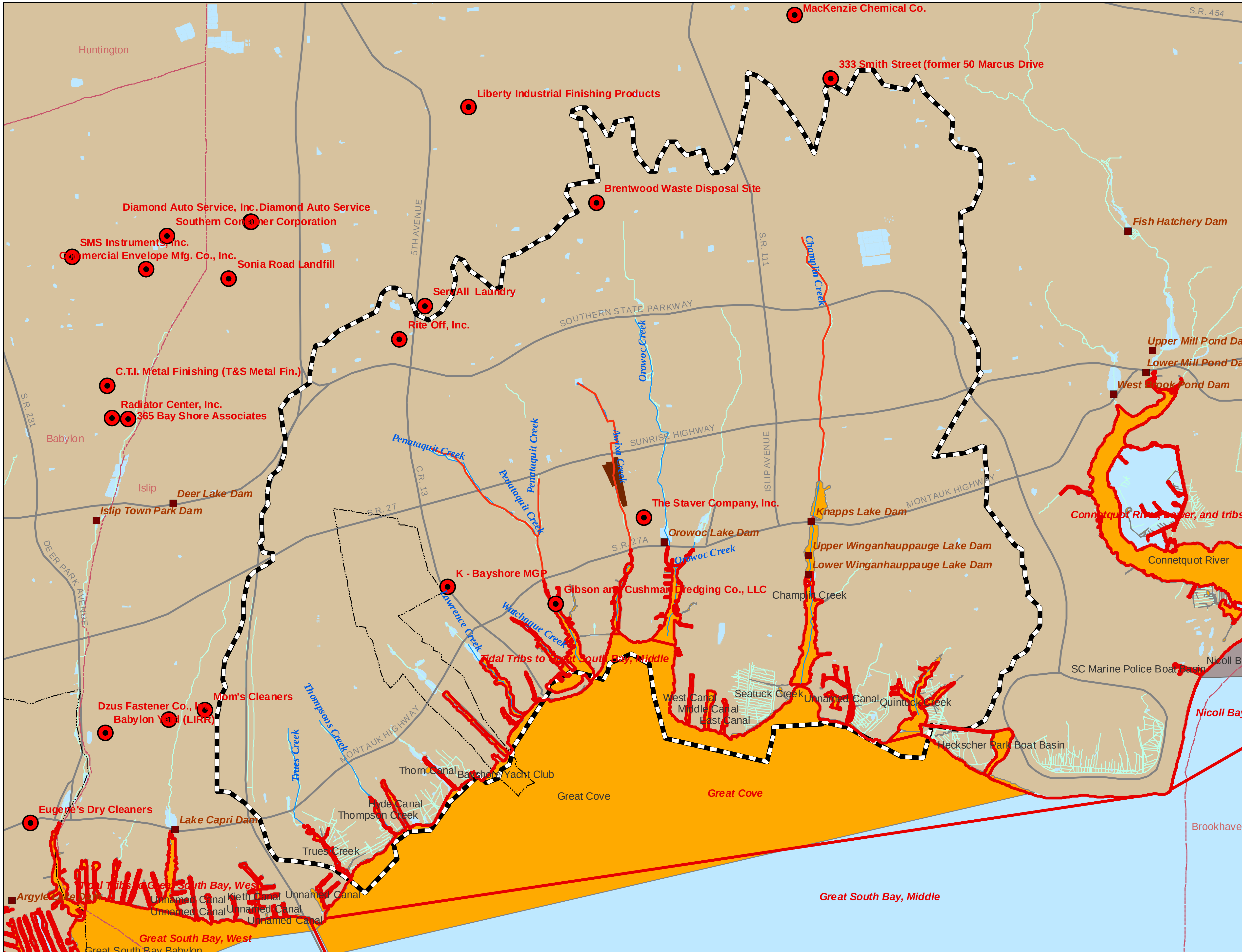

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 2-7
KNOWN ISSUES & IMPAIRMENTS

SOURCE: NYSGIS Clearinghouse; NYSDEC
SOURCE DATE: June 2010

Legend

- Great Cove Overall Watershed Boundary
- Town Boundary
- Village Boundary
- Surface Water
- Impaired Estuary - 2010 303(d) List
- Streams (SSER)
- Impaired Stream - 2010 303(d) List
- Main Roads
- NYSDEC-Inventoried Dams
- Remediation Sites (NYS Superfund Site)
- Former Town Landfill

Shellfish Bed Status

- Closed
- Holiday
- Seasonal

1 inch = 4,000 feet

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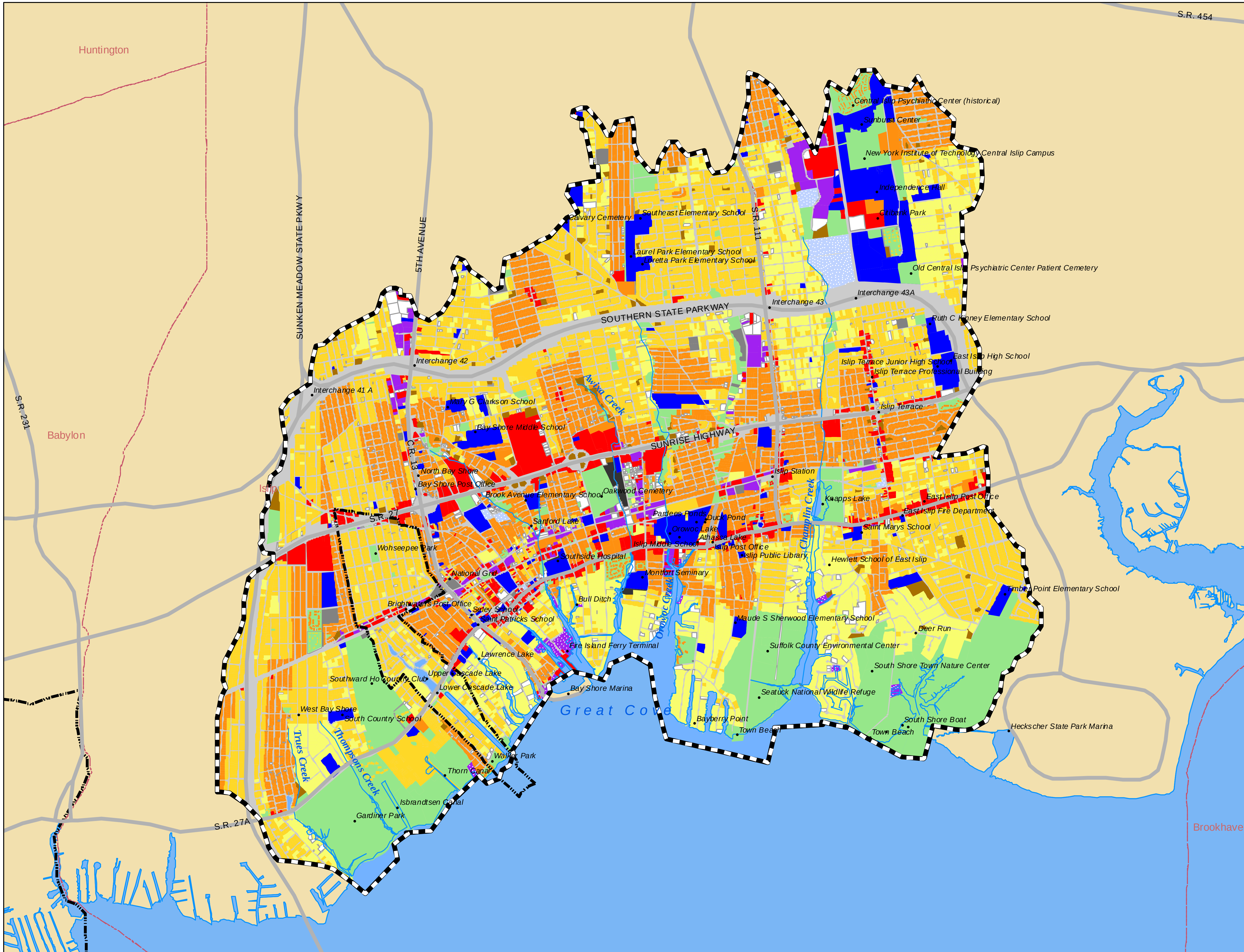
GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 2-8
LAND USE

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS; Suffolk County Real Property
SOURCE DATE: July 2010



Legend

- Great Cove Overall Watershed Boundary
- Streams
- Village Boundary
- Town Boundary
- Shoreline

Land Use

- Agriculture
- Commercial
- High Density Residential
- Medium Density Residential
- Low Density Residential
- Institutional
- Industrial
- Marina
- Recreation & Open Space
- Surface Waters & Wetlands
- Flood Control/Recharge Basins
- Publicly Owned Maintenance Yard
- Transportation
- Utilities
- Waste Handling & Management
- Vacant

1 inch = 4,000 feet

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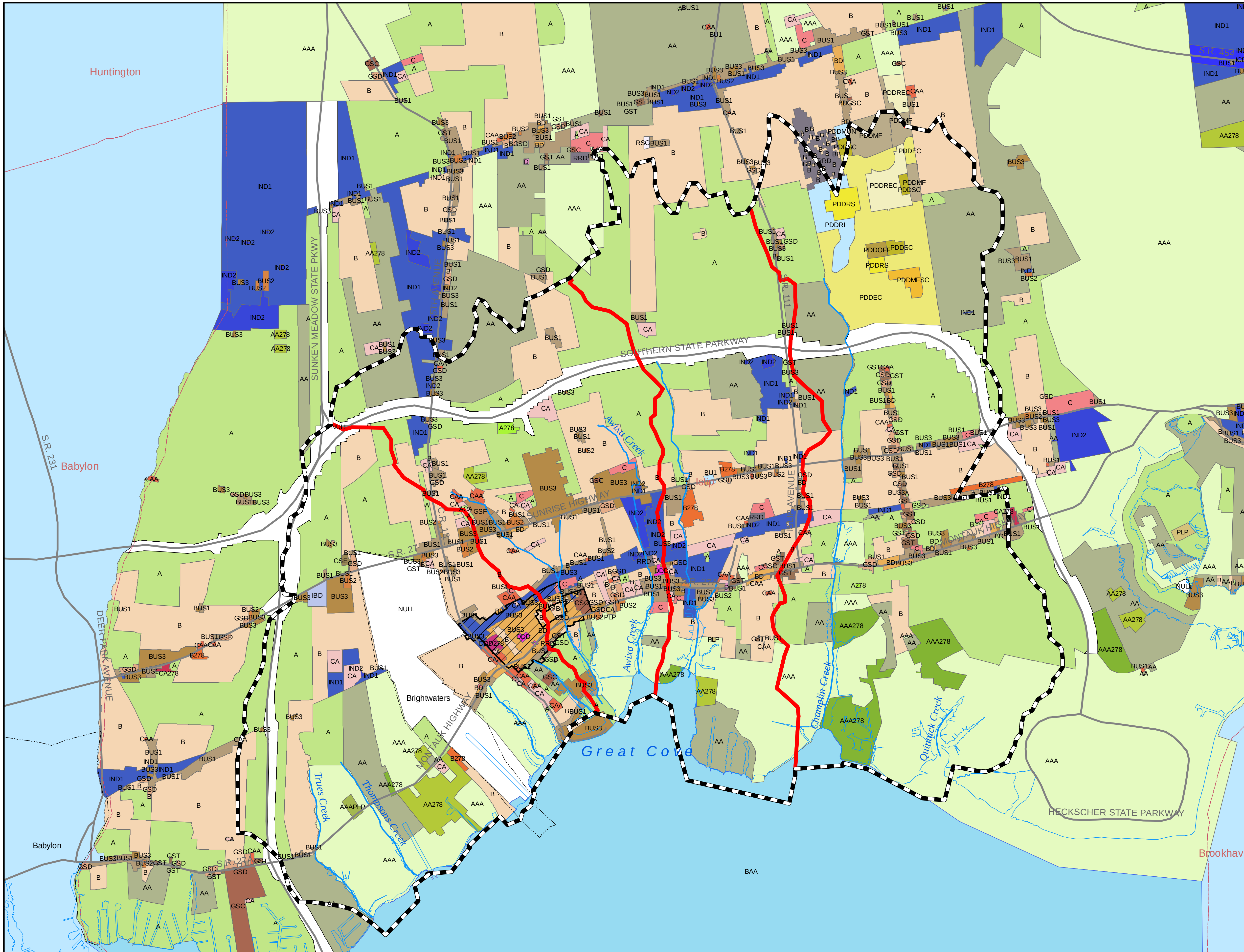

Town of Islip and New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 2-9
ZONING MAP

SOURCE: NYSGIS Clearinghouse; Town of Islip GIS; USGS
SOURCE DATE: February 2010

Legend

- Great Cove Overall Watershed Boundary
- Sub-Areas
- Town Boundary
- Downtown Development Overlay District
- Village Boundary
- Main Roads
- Streams

Zoning

A, A278, AA, AA278, AAA, AAA278, AAAB, AAAPLP, B, B278, BAA, BD, BUS1, BUS2, BUS3, C, C278, CA, CA278, CAA, CAA278, D, DDD, DDD278, GD, GSC, GSD, GSE, GSF, GST, IBD, ICD, IND1, IND2, NO DATA, PDDEC, PDDMF, PDDMFSC, PDDOFF, PDDREC, PDDRS, PDDSC, PLP, RRD, RSG

1 inch = 4,000 feet

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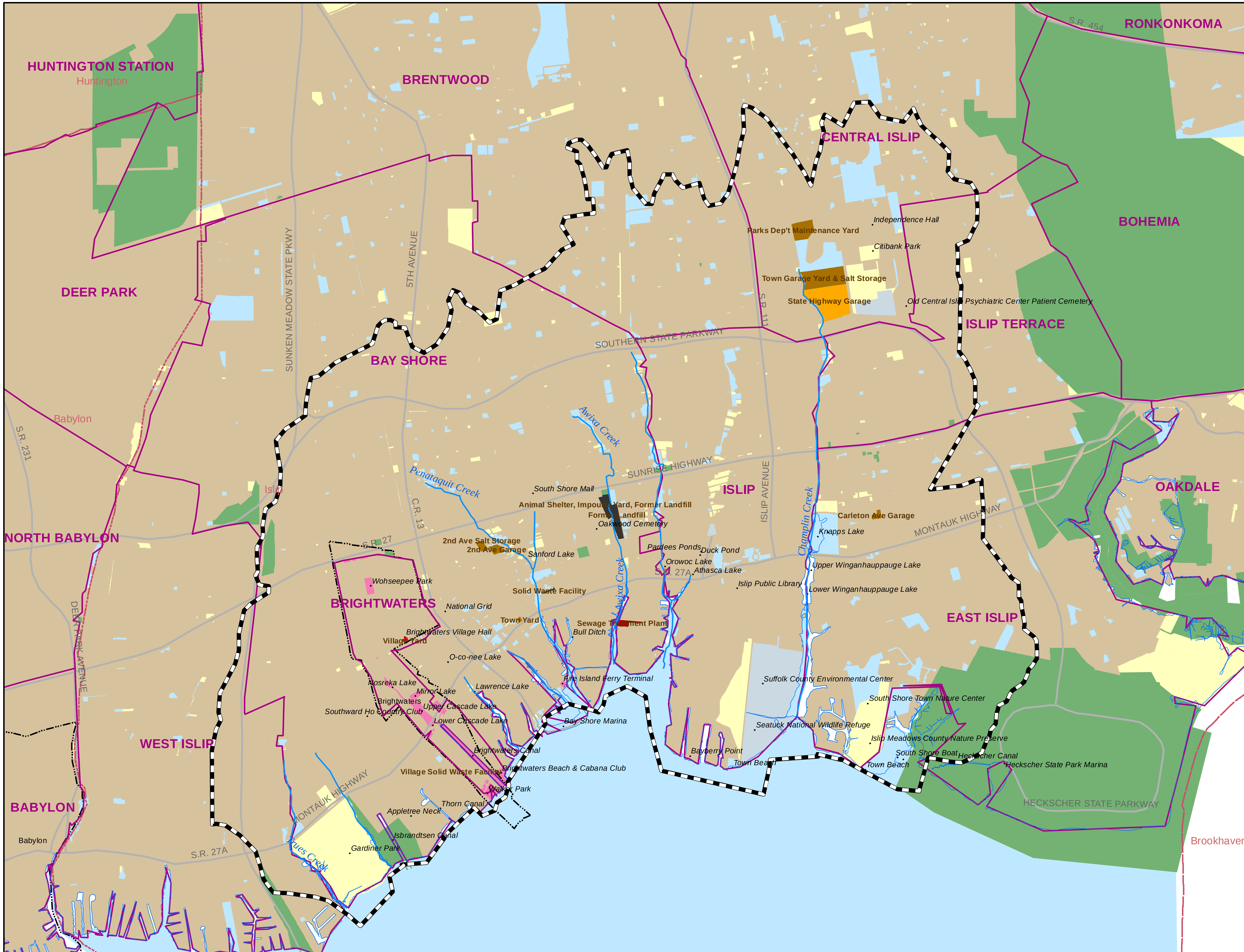
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 2-10
PUBLICLY OWNED LANDS

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS; NYSDEC
SOURCE DATE: December 2010



Legend

Great Cove Overall Watershed Boundary
Streams
Hamlet
GNIS_selection
Village Boundary
Town Boundary
Main Roads

Highway Maintenance & Waste Handling

Town Highway Yard
State Highway Yard
Village Highway Yard
Solid Waste Facility
Sewage Treatment Plant Facility

Publicly Owned Land

County Owned
Village Owned
Town of Islip Owned
State Owned
Federally Owned

1 inch = 4,000 feet

N

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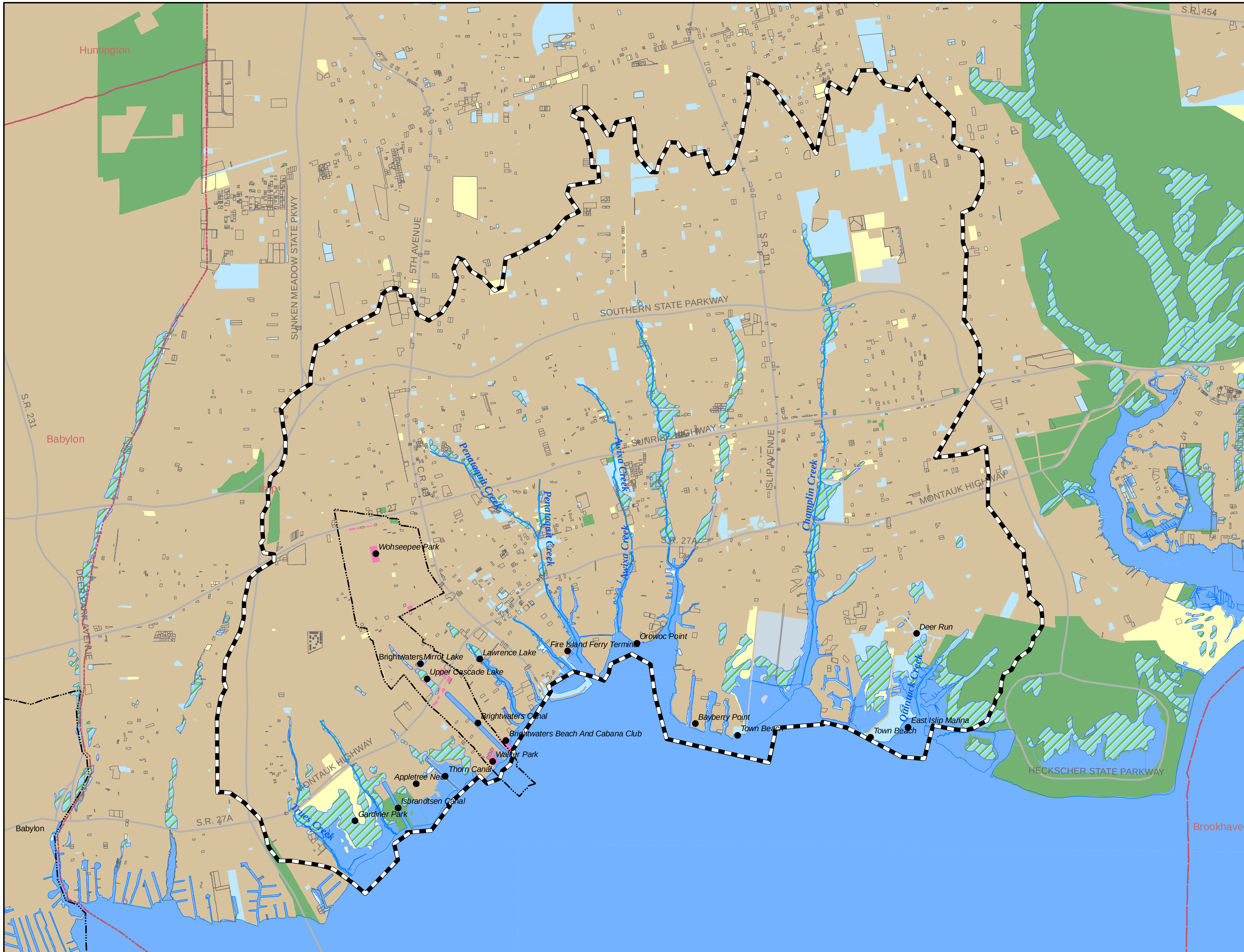
Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 2-11
VACANT LANDS

SOURCE: NYSGIS Clearinghouse; NYSDEC; Town of Islip; Suffolk County Real Property
SOURCE DATE: July 2010



Legend

- Great Cove Overall Watershed Boundary
- Village Boundary
- Town Boundary
- Main Roads
- Streams
- Vacant Land
- NYSDEC Freshwater Wetlands
- NYSDEC Tidal Wetlands

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 4,000 feet

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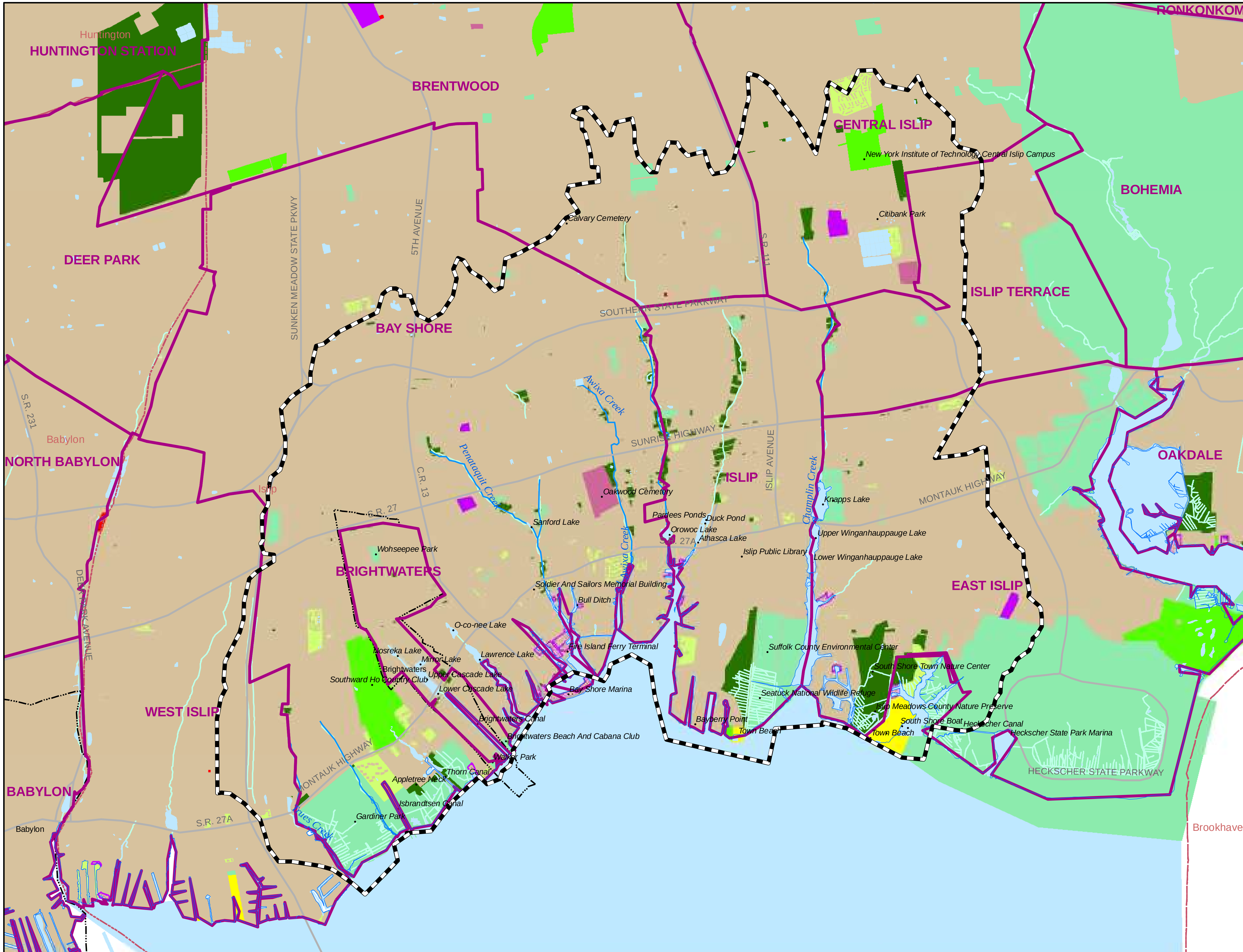

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED
MANAGEMENT PLAN

FIGURE 2-12
Public Access, Recreation & Open Space

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS; NYSDEC
SOURCE DATE: July 2010

Legend

- Great Cove Overall Watershed Boundary
- Hamlet
- Village Boundary
- Town Boundary
- Main Roads
- Streams (SSER)
- Marinas
- Surface Water

Recreation & Open Space

- Boys and/or Girls Camp
- Camping
- Beach
- Playground
- Athletic Fields
- Golf Course/Country Club
- Park & Recreational Area
- Conservation Land
- Private Open Space
- Cemetery

1 inch = 4,000 feet

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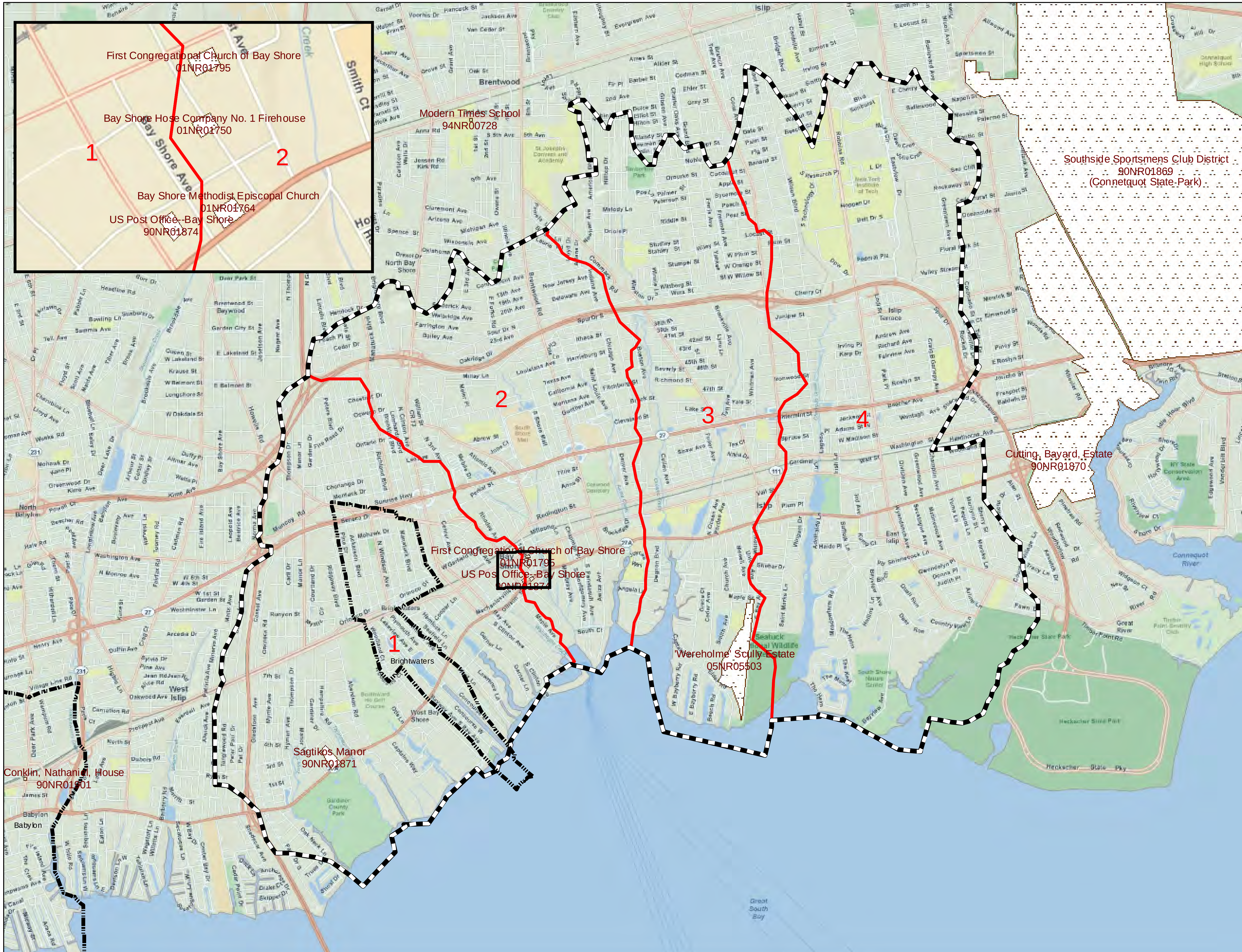
and
New York Department of State

GREAT COVE WATERSHED
MANAGEMENT PLAN

FIGURE 2-13
CULTURAL AND HISTORIC RESOURCES

SOURCE: Town of Islip GIS; ESRI World Street Map, NYS OPRHP
SOURCE DATE: February 2010



Legend

- Great Cove Overall Watershed Boundary
- Sub-Areas
- Village Boundary
- Historic Site

1 inch = 4,000 feet

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APPENDICES

APPENDIX A

PUMP-OUT LOCATION INFORMATION

New York State Clean Vessel Assistance Program
New York State Environmental Facilities Corporation
625 Broadway, Albany, NY 12207-2997
1-800-882-9721/518-402-7461
Website: www.nysefc.org E-Mail: CVAP@nysefc.org

Town of Islip - OPRHP - Bay Shore Marina	County: Suffolk
Address:	
South Clinton Ave	Dates of Operation: April - September
Bay Shore, NY 11706	Hours of Operation: 24 Hours
Telephone: (631) 224-5648	Days of Operation: Mon - Sun
Website: www.isliptown.org	Operation Type: Self Service
VHF Channel: 73	Pumpout Fee: $0.00
Latitude: 40.712817	Longitude: -73.237808
Other Contact Information:	

Town of Islip - South Shore Boat	County: Suffolk
Address:	
Bayview Ave	Dates of Operation: May - November
East Islip, NY 11730	Hours of Operation: 8 AM - 6 PM
Telephone: (631) 224-5645	Days of Operation: Mon - Sun
Website: www.isliptown.org	Operation Type: Attendant Use Only
VHF Channel: 73	Pumpout Fee: $0.00
Latitude: 40.707442	Longitude: -73.188292
Other Contact Information:	

New York State Clean Vessel Assistance Program
New York State Environmental Facilities Corporation
625 Broadway, Albany, NY 12207-2997
1-800-882-9721/518-402-7461
Website: www.nysefc.org E-Mail: CVAP@nysefc.org

Town of Islip - OPRHP - East Islip Marina	County: Suffolk
Address:	
Bayview Ave	Dates of Operation: April 1 – Nov. 15
East Islip, NY 11730	Hours of Operation: 24 hours
Telephone: (631) 224-5648	Days of Operation: Mon - Sun
Website: www.isliptown.org	Operation Type: Self Service
VHF Channel: 73	Pumpout Fee: $0.00
Latitude: 40.707681	Longitude: -73.187942
Other Contact Information:	

NYSOPRHP - Heckscher State Park	County: Suffolk
Address:	
Heckscher State Parkway, End of Southern State Parkway	Dates of Operation: April 1 - November 1
East Islip, NY 11730	Hours of Operation: 7 AM - Sunset
Telephone: (631) 581-2100	Days of Operation: Mon - Sun
Website: www.nysparks.state.ny.us	Operation Type: Boater Use - Switch
VHF Channel: None	Pumpout Fee: $0.00
Latitude: 40.706111	Longitude: -73.174444
Other Contact Information:	

APPENDIX B

SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT NARRATIVES

Attachment B:

COASTAL FISH & WILDLIFE HABITAT ASSESSMENT FORM

Name of Area:	**Great South Bay-West**
Designated:	**March 15, 1987**
Date Revised:	**December 15, 2008**
County:	**Suffolk**
Town(s):	**Babylon, Islip**
7½' Quadrangle(s):	**Amityville, NY; Bay Shore West, NY; Bay Shore East, NY; West Gilgo Beach, NY**

Assessment Criteria **Score**

Ecosystem Rarity (ER)–the uniqueness of the plant and animal community in the area and the physical, structural, and chemical features supporting this community.

ER assessment: One of the largest shallow coastal wetland ecosystems in New York State. **64**

Species Vulnerability (SV) – the degree of vulnerability throughout its range in New York State of a species residing in the ecosystem or utilizing the ecosystem for its survival. (E= Endangered, T= Threatened, SC= Special concern)

SV assessment: Roseate tern (E), common tern (T), northern harrier (T), osprey (SC) and black skimmer (SC). Black rail (E) nest in area, but not well documented. Additive division: 36 + 25/2 + 25/4 +16/8 + 16/16 = 57.75 **57.75**

Human Use (HU) – the conduct of significant, demonstrable, commercial, recreational, or educational wildlife-related human uses, either consumptive or non-consumptive, in the area or directly dependent upon the area.

HU assessment: Sportfishing of statewide significance, waterfowl hunting of regional significance and shellfish hatcheries of local significance. Additive division: 16 + 9/2 + 4/2= 22.5 **22.5**

Population Level (PL) – the concentration of a species in the area during its normal, recurring period of occurrence, regardless of the length of that period of occurrence.

PL assessment: This area supports some of the largest concentrations of wintering waterfowl, nesting northern harriers (T), estuarine fish, and the only population of black rails (E) in New York State. **16**

Replaceability (R) – ability to replace the area, either on or off site, with an equivalent replacement for the same fish and wildlife and uses of those same fish and wildlife, for the same users of those fish and wildlife.

R assessment: Irreplaceable. **1.2**

Habitat Index: (ER + SV + HU + PL) = 160.25 **Significance: (HI x R) = 192.3**

NEW YORK STATE
SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT
NARRATIVE

GREAT SOUTH BAY-WEST

LOCATION AND DESCRIPTION OF HABITAT:

Great South Bay-West is located along the south shore of Long Island, east of South Oyster Bay, in the Towns of Babylon and Islip, Suffolk County (7.5' Quadrangles: Amityville, N.Y.; West Gilgo Beach, N.Y.; Bay Shore West, N.Y.; and Bay Shore East, N.Y.). This area is approximately 34,170 acres and is generally defined by the mean high water elevation on the north and south sides, by the Amityville Cut boat channel on the west, and by the Islip-Brookhaven town line on the east. The fish and wildlife habitat is the entire western half of Great South Bay. The bay is bordered on the north by dense residential and commercial development, including extensive marina and harbor facilities. The remainder of the area is bordered by State parklands, open water, and low density residential development on Fire Island.

A number of benthic habitats make up the bay bottom; the dominant eelgrass (*Zostera marina*) community has been studied extensively. Benthic habitat in Great South Bay can be classified as muddy sandflat and sandflat habitats. Much of the bay is shallow open water habitat, but as the bay narrows on the western end open water merges into an extensive series of tidal salt marshes, salt marsh islands, and intertidal mudflats. Extensive salt marshes also line the bay where tidal creeks and rivers feed into the bay from the mainland. Cordgrasses (*Spartina alterniflora* and *S. patens)* dominate the low and high salt marsh, respectively. Dwarf glasswort (T) (*Salicornia bigelovii*) which is associated with smooth cordgrass, is one of the main species within a salt panne community on the Gilgo Beach Backbarrier Marsh portion of Great South Bay-West. Common reed (*Phragmites australis*) borders portions of the high marsh, grading to dense thickets of bayberry (*Myrica pensylvanica*), poison ivy (*Toxicodendron radicans*), groundsel-bush (*Baccharis halimifolia*), and marsh elder (*Iva frutescens*) in drier areas. On the barrier beaches bordering the Atlantic Ocean and in swales behind primary dunes, plants characteristic of stabilized older dune and coastal shrub communities are found.

Water depths in this area are generally less than 6 feet below mean low water, except in Fire Island Inlet and in some dredged navigation channels. Tidal range in the bay averages approximately 2.61 feet at the inlet and approximately 0.7 feet at the mouth of the Connetquot River. Great South Bay is the only bay on Long Island’s south shore that has major riverine input (from the Carmans Rivers in the east and Connetquot River in the west). In addition, the bay receives as much as 11% of its freshwater input directly from groundwater flows through its floor. Fire Island Inlet is the only direct connection to the sea, with indirect connections through South Oyster Bay.

FISH AND WILDLIFE VALUES:

Great South Bay-West comprises approximately one-half of the largest protected, shallow, coastal saltwater bay in New York State. A tremendous diversity of fish and wildlife species occur in this vast wetland area. Many species of migratory birds nest among the salt marshes and dredged material islands in Great South Bay-West. The Captree Island vicinity is recognized as an Important Bird Area by the National Audubon Society of New York State, and serves as foraging habitat for peregrine falcon (E) and other migrating raptors. According to data from 1993-2005, Great South Bay-West is home to an average of 12 nesting pairs of roseate terns (E) per year (28 in peak year). In New York, this species breeds only on Long Island. In recent years, common terns (T) have been confirmed nesting on Elder Island, Dock Island, Goose Flat, Thatch Island, The Grouts, and Captree Island. From 1993 to 2005, an average of 1,046 breeding pairs of common tern (T) per year were reported in Great South Bay-West (2,333 in peak year). Recent data for least tern (T) is only available for 1992 and 2002, with 10 breeding pairs and 86 breeding pairs, respectively, in Great South Bay-West. Terns typically nest in simple scrapes built above the high tide mark in sand or gravel, and may be sparsely lined with shells and other debris (e.g. seaweed). Tern breeding colonies may contain several hundred to several thousand birds, including roseate (E), least (T), common (T), and gull-billed terns, along with black skimmer. Productivity of the surrounding waters is of vital importance to common terns (T) because they feed on small fish, shrimp, and aquatic insects.

Several rookeries have been located on islands within Great South Bay-West, including Gilgo Island, Sexton Island, Seganus Thatch, Ox Island, Pipe Island, Nazeras Island, the Cedar Island Group, and an unnamed dredged material island southwest of Nazeras Island. These birds use a network of islands in the bays, with shifts in island use from year to year. Species nesting in these areas include great egret, snowy egret, yellow-crowned night heron, black-crowned night heron, green-backed heron, little blue heron, tri-colored heron, and glossy ibis. Although the numbers of black-crowned night heron appear to be declining, records for the years 1993, 1995, 1998, 2001, and 2004 (the years in between were not surveyed) indicate an annual average of approximately 58 breeding pairs (195 in peak year) in Great South Bay-West. Other bird species which nest in Great South Bay-West include Canada goose, herring gull, great black-backed gull, American oystercatcher, black skimmer (SC), American black duck, mallard, gadwall, willet, Virginia rail, clapper rail, marsh wren, sharp-tailed sparrow, and seaside sparrow (SC). The vast salt marshes, intertidal flats, and shallows in this area provide valuable feeding areas for birds throughout the year, including species nesting in the area and large concentrations of shorebirds during migration, including whimbrel, yellowlegs, and black-bellied plover.

Great South Bay-West is also home to several raptor species. In Great South Bay-West, an estimated annual average of 12 breeding pairs of osprey (SC) were observed from 1998 to 2003 on the salt marsh islands. One pair of peregrine falcon (E) was observed in Great South Bay-West on Captree Island in 2004, but nesting was not confirmed. Peregrine falcons generally return to the same nesting location annually and mate for life. At least 2 to 3 northern harrier (T) nests have been observed in stands of common reed and poison ivy in the Gilgo Beach backbarrier marsh by the New York State Breeding Bird Atlas Project, but additional surveys are needed to better establish how many breeding pairs are regularly using the area. Northern harriers (T) here may reach their highest breeding densities in the state and, possibly, the region. It is the only area in New York State where black rails (E) have been found, and is the only historically documented breeding location for soras on Long Island. The first nesting record for black rails (E) was recorded in 1937, and since 1968 they have been present along the backbarrier marshes of Gilgo State Park during approximately half of the breeding seasons. Northern harriers (T) and short-eared owls (SC) are common winter residents of the marshes in Great South Bay-West. An observer for the New York State Breeding Bird Atlas Project recorded probable breeding for short-eared owl (SC) in June of 2001. All of the salt marsh and dune areas north of the Ocean State Parkway on Jones Beach Island represent suitable short-eared owl (SC) habitat and any breeding owls present could be expected to forage over the majority of this area.

In addition, Great South Bay-West is one of the most important waterfowl wintering areas (November - March) on Long Island, especially for brant and scaup. Mid-winter aerial surveys of waterfowl abundance from 1986 to 1998 (excluding 1997) for all of Great South Bay indicate average concentrations of over 7,000 birds in the bay each year (18,008 in peak year), including 4,085 greater and/or lesser scaup (15,405 in peak year), 583 American black duck (1,255 in peak year), 417 (common, hooded, and/or red-breasted) merganser (1,025 in peak year), 648 brant (2,260 in peak year), 691 Canada goose (1,285 in peak year), and 314 common goldeneye (990 in peak year), along with lesser numbers of bufflehead, mallard, canvasback, long-tail duck, and American coot. Waterfowl abundance in the waters surrounding East and West Fire Island (located in Great South Bay-West) were surveyed separately for the years from 1986 through 1998. The records from this survey indicate average concentrations of 1,299 birds in the bay each year, including 496 greater and/or lesser scaup (4,900 in peak year), 209 (common, hooded, and/or red-breasted) merganser (1,800 in peak year), and 113 American black duck (387 in peak year). Based on these surveys, Great South Bay-West supports one of the largest concentrations of wintering waterfowl in New York State although flocks of waterfowl are not evenly distributed throughout the bay. Dabbling ducks, including American black duck and mallard, are concentrated in the shallow water and marsh areas behind the barrier islands and the Connetquot River Estuary. Generally, brant and geese feed in open water areas through midwinter, while later in spring (prior to migration), the birds feed extensively in the salt marshes. Waterfowl use of the bay during winter is influenced in part by the extent of ice cover each year. Concentrations of waterfowl also occur in the area during spring and fall migrations (March - April and October - November, respectively). Nearly all of Great South Bay-West is open to the public for waterfowl hunting, and the area supports regionally significant hunting pressure.

In addition to having significant bird concentrations, Great South Bay-West is an extremely productive area for marine finfish, shellfish, and other wildlife. Much of this productivity is directly attributable to the extensive salt marshes and tidal flats that line the mainland and barrier islands, the estuarine habitats around stream and river outlets on the mainland, and the sandy shoals and extensive eelgrass beds that characterize the open water areas of the bay. During eight years of surveys by the New York Department of Environmental Conservation, 85 species of fish have been identified, 40 of which occur regularly in the bay. Silversides, Atlantic menhaden, killifishes, and bay anchovy account for over 90% of all the fish caught and are the most abundant fish species in the bay. Atlantic silversides are found virtually everywhere throughout the bay. Bay anchovy is a main inhabitant of the mid-bay water column during its spawning time in late June and July. The killifishes include mummichog in the salt marshes, striped killifish over sandy habitats, and sheepshead minnow which occupy both the salt marsh and sandy habitats. Sticklebacks spawn in association with the submerged aquatic vegetation (SAV) in the spring and summer.

The abundance of forage species in Great South Bay-West contributes to its importance as a major nursery and feeding area (April - November, generally) for a number of estuarine-dependent, commercially and recreationally important species, including summer flounder, winter flounder, bluefish, striped bass, weakfish, tomcod and tuatog. The bay is particularly significant as a nursery area for the young-of-the-year and juvenile Hudson River striped bass and juvenile bluefish, as well as older striped bass during the summer months. The bay area also serves as an important nursery area for reef species, including tuatog, cunner, and black sea bass due to the cover and prey species provided by areas of vegetation. Fire Island Inlet is an especially significant component of the habitat; as a corridor for fish migrations, as a source for the exchange and circulation of bay waters, and as an area where feeding by many fish and wildlife species is concentrated (including adult striped bass and bluefish). The most abundant winter species in the bay, the plankton-eating American sandlance, is important as a forage base for both predatory fish and roseate terns (E). As a result, the inlet is the most important foraging area for roseate terns (E) on western Long Island. As a result of the abundant fisheries resources in the bay (summer flounder especially), Great South Bay-West receives heavy recreational fishing pressure, of statewide significance. Commercial baitfisheries have been established in shoal areas near Fire Island Inlet.

Other common aquatic species occurring in Great South Bay-West include blue mussel, bay scallop, horseshoe crab, American eel, Atlantic croaker, northern kingfish, and northern puffer. Historically, the bay supported an economically significant shellfishery for northern quahog and the bay still remains a major spawning, nursery, and foraging area for blue crab. The entire bay area is inhabited by hard clams and the islands along the south shore support soft clams and ribbed mussels. Most of the bay waters are certified for shellfishing, resulting in a commercial and recreational harvest of local significance. Hard clam densities within the Babylon waters of Great South Bay averaged 3.35 clams per square meter from 2001 to 2002, with an average of 2.85 hard clams per square meter in certified waters. Landings data reported by the New York State Department of Environmental Conservation indicate an annual average of 2,371 total bushes of hard clams harvested within the Town of Babylon’s waters within Great South Bay from 1993 to 2003. Clam Pond, on the north shore of Fire Island, also contains a population of bay scallops which have been reintroduced to the area. There are a number of shellfish aquaculture sites along the south shore of Long Island. Within Great South Bay-West, there are three small-scale shellfish hatcheries (grow-out rafts or floating upweller systems) and one significant hatchery.

Other wildlife species within the habitat include harbor seals that frequently use both sides of the Fire Island Inlet as haulout sites and are frequently sighted in the bay during the winter months. In recent years, sightings of grey seal have increased in this area as well. Sea turtles, including juvenile Atlantic ridley (E), juvenile loggerhead (T), and juvenile and adult green sea turtles (T), regularly use the Great South Bay. Diamondback terrapin reside among the salt marsh islands in the bay, and utilize sandy areas along the south shore for egg-laying.

Great South Bay-West has over 10,818 acres of submerged rooted aquatic vegetation beds, accounting for approximately 33% of the entire habitat area. These beds are dominated primarily by eelgrass with some wigeon grass (*Ruppia maritima*). Submerged aquatic vegetation beds provide spawning and foraging habitat for an array of mollusks, crustaceans, juvenile fish, as well as diving ducks. The distribution and abundance of benthic species in the bay's eelgrass community are likely controlled by a number of factors that include eelgrass stem density, water temperature and salinity, sediment type, predation, food supply, and human harvest.

IMPACT ASSESSMENT:

Any activities that would degrade water quality, increase turbidity, increase sedimentation, or alter flows, temperature, or water depths would affect the biological productivity of this area. All species would be adversely affected by water pollution, such as chemical contamination (including food chain effects resulting from bioaccumulation), oil spills, excessive turbidity or sediment loading, non-point source run-off, waste disposal (including vessel wastes), and stormwater runoff. Efforts should be made to improve water quality in the bay, including the reduction or elimination of discharges from vessels and upland sources, effective oil and toxic chemical spill prevention and control programs, upgrading of wastewater treatment plants, enactment of pet waste ordinances to reduce coliform contributions to the bay, and the implementation of erosion control and stormwater pollution prevention best management practices. Vegetated upland buffer zones (e.g. wetlands, dunes, and forested areas) should be protected or established to reduce non-point source pollution and sedimentation from upland sources.

Alteration of tidal patterns in Great South Bay-West, by modification of inlet configurations or other means (e.g., sediment removal by dredging, channelization, bulkheading), would have negative impacts on the biotic communities present. No new navigation channels should be excavated within the area. Dredging to maintain existing boat channels in the bay should be scheduled in between September 15 and December 15 to minimize adverse effects on aquatic organisms. Unregulated dredged material placement in this area would be detrimental to the habitat, but such activities may be designed to maintain or improve the habitat for certain species of wildlife.

Construction of shoreline structures, such as docks, piers, bulkheads, or revetments, in areas not previously disturbed by development (e.g., natural salt marsh, tidal flats, or shallows), would result in the loss of productive areas which support the fish and wildlife resources of Great South Bay -West. Elimination of salt marsh and intertidal areas, through loss of intertidal connection, ditching, excavation, or filling, would result in a direct loss of a valuable habitat. Restoration of previously connected portions of the habitat, including the removal of structures (e.g. bulkheads, groins, jetties) which disrupt natural sedimentation and deposition patterns and physically alter the habitat may be beneficial. Construction of new and maintenance of existing erosion control structures which interfere with natural coastal processes should be carefully evaluated for need and where possible, non-structural solutions should be utilized.

Unrestricted use of motorized vessels, including personal watercraft, in shallow waters can have adverse effects on the benthic community, and on fish and wildlife populations through resuspension of seafloor sediments and through shoreline erosion which may reduce water clarity and increase sedimentation. Use of motorized vessels should be controlled (e.g., no wake zone, speed zones, zones of exclusion) in and adjacent to shallow waters and adjacent wetlands. Docks, piers, catwalks, or other structures may be detrimental to submerged aquatic vegetation (SAV) beds through direct or indirect effects from shading, mooring chain scarring, and other associated human uses. Where environmental parameters are appropriate, opportunities for restoration of SAV beds may exist. Any restoration of SAV beds should utilize the best available science and implement proper monitoring protocols.

Thermal discharges, depending on time of year, may have variable effects on use of the area by marine species, such as sea turtles and overwintering waterfowl. Installation and operation of water intakes could have significant impact on juvenile (and adult, in some cases) fish concentrations, through impairment or entrainment. Activities that would enhance migratory, spawning, or nursery fish habitat, particularly where an area is essential to a species' life cycle or helps to restore a historic species population would be beneficial. Where appropriate, hydrological modifications (e.g. dams, dikes, channelization, bulkheading, sedimentation, etc.) should be mitigated or removed, including the rejoining of formerly connected tributaries, and the removal of obstructions or improvements to fish passage.

Nesting birds inhabiting the islands, marshes and barrier beaches of Great South Bay -West are highly vulnerable to disturbance by humans from March 15 through August 15. Significant pedestrian traffic or recreational use (e.g., boat and personal watercraft landing, off-road vehicle use, picnicking) of the marsh islands could easily eliminate the use of this site as a breeding area and should be minimized during this period. Predation of chicks and destruction of eggs or nests by unleashed pets (e.g., dogs, cats) and natural predators may also occur, and predator control should be implemented where feasible. Fencing and/or annual posting of the bird nesting area should be provided to help protect the nesting bird species.

Activities to protect or restore wetland habitat in Great South Bay -West, consistent with best management practices, (including the restoration of historic tidal regime, planting of native vegetation, control of invasive species, etc.) may enhance habitat values for fish and wildlife species.

HABITAT IMPAIRMENT TEST:

A **habitat impairment test** must be applied to any activity that is subject to consistency review under federal and State laws, or under applicable local laws contained in an approved local waterfront revitalization program. If the proposed action is subject to consistency review, then the habitat protection policy applies, whether the proposed action is to occur within or outside the designated area.

The specific **habitat impairment test** is as follows.

> In order to protect and preserve a significant habitat, land and water uses or development shall not be undertaken if such actions would:
>
> - destroy the habitat; or,
> - significantly impair the viability of a habitat.

Habitat destruction is defined as the loss of fish or wildlife use through direct physical alteration, disturbance, or pollution of a designated area or through the indirect effects of these actions on a designated area. Habitat destruction may be indicated by changes in vegetation, substrate, or hydrology, or increases in runoff, erosion, sedimentation, or pollutants.

Significant impairment is defined as reduction in vital resources (e.g., food, shelter, living space) or change in environmental conditions (e.g., temperature, substrate, salinity) beyond the tolerance range of an organism. Indicators of a significantly impaired habitat focus on ecological alterations and may include but are not limited to reduced carrying capacity, changes in community structure (food chain relationships, species diversity), reduced productivity and/or increased incidence of disease and mortality.

The *tolerance range* of an organism is not defined as the physiological range of conditions beyond which a species will not survive at all, but as the ecological range of conditions that supports the species population or has the potential to support a restored population, where practical. Either the loss of individuals through an increase in emigration or an increase in death rate indicates that the tolerance range of an organism has been exceeded. An abrupt increase in death rate may occur as an environmental factor falls beyond a tolerance limit (a range has both upper and lower limits). Many environmental factors, however, do not have a sharply defined tolerance limit, but produce increasing emigration or death rates with increasing departure from conditions that are optimal for the species.

The range of parameters which should be considered in applying the habitat impairment test include but are not limited to the following:

1. physical parameters such as living space, circulation, flushing rates, tidal amplitude, turbidity, water temperature, depth (including loss of littoral zone), morphology, substrate type, vegetation, structure, erosion and sedimentation rates;

2. biological parameters such as community structure, food chain relationships, species diversity,

predator/prey relationships, population size, mortality rates, reproductive rates, meristic features, behavioral patterns and migratory patterns; and,

3. chemical parameters such as dissolved oxygen, carbon dioxide, acidity, dissolved solids, nutrients, organics, salinity, and pollutants (heavy metals, toxics and hazardous materials).

Although not comprehensive, examples of generic activities and impacts which could destroy or significantly impair the habitat are listed in the Impact Assessment section to assist in applying the habitat impairment test to a proposed activity.

KNOWLEDGEABLE CONTACTS:

New York State Department of State
Division of Coastal Resources
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99 Washington Avenue
Albany, NY 12231
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NYSDEC - Region 1
State University of New York, Building 40
Stony Brook, NY 11790
Phone: (631) 444-0204

NYSDEC
Bureau of Marine Resources
205 N. Belle Meade Road, Suite # 1
East Setauket, NY 11733
Phone: (631) 444-0430

New York Natural Heritage Program
625 Broadway, 5th floor
Albany, NY 12233
Phone: (518) 402-8935

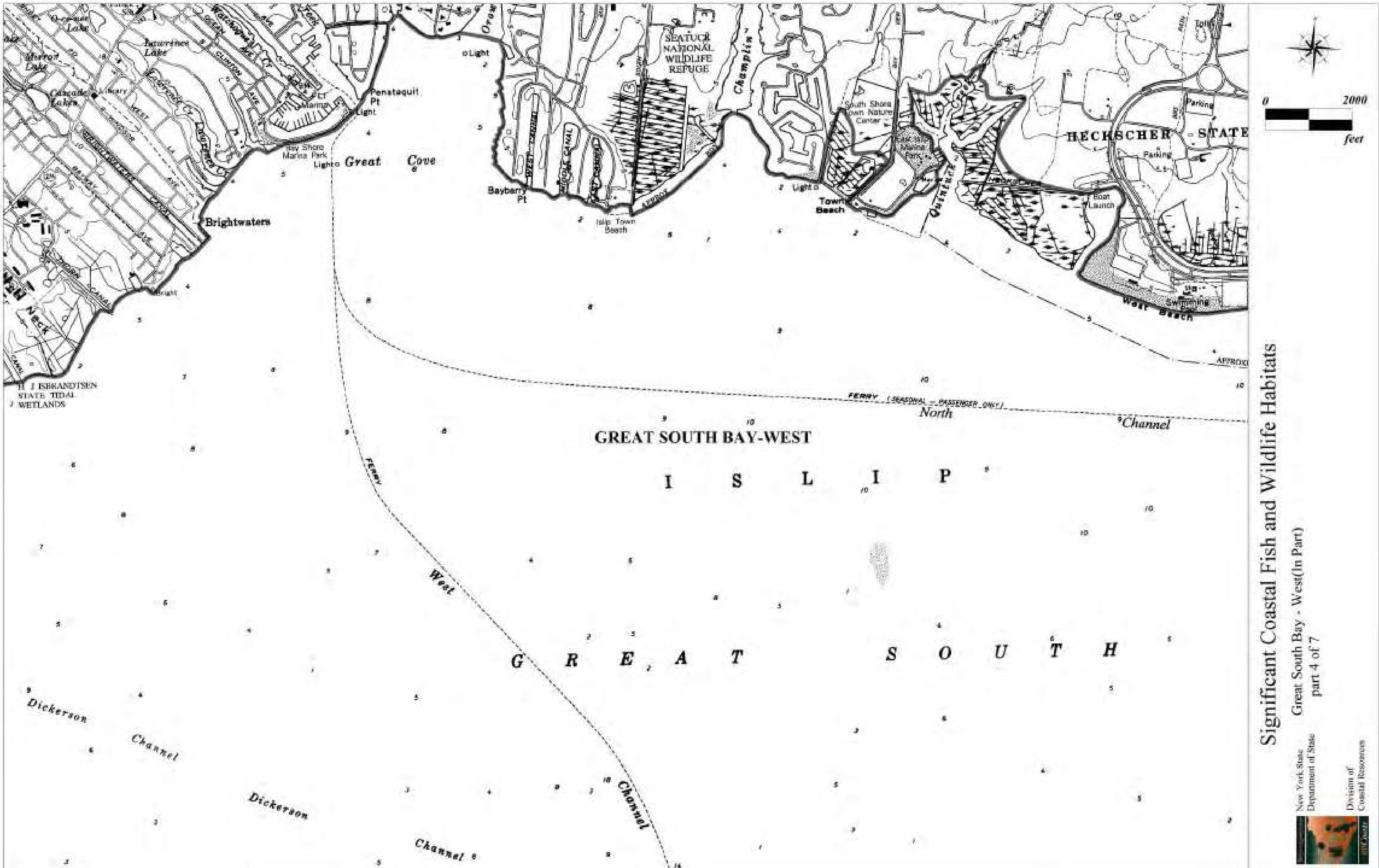
Town of Babylon
Department of Environmental Control
281 Phelps Lane
N. Babylon, NY 11703
(631) 422-7640

Town of Islip
Planning Department
655 Main Street
Islip, NY 11751
Phone: (631) 224-5450

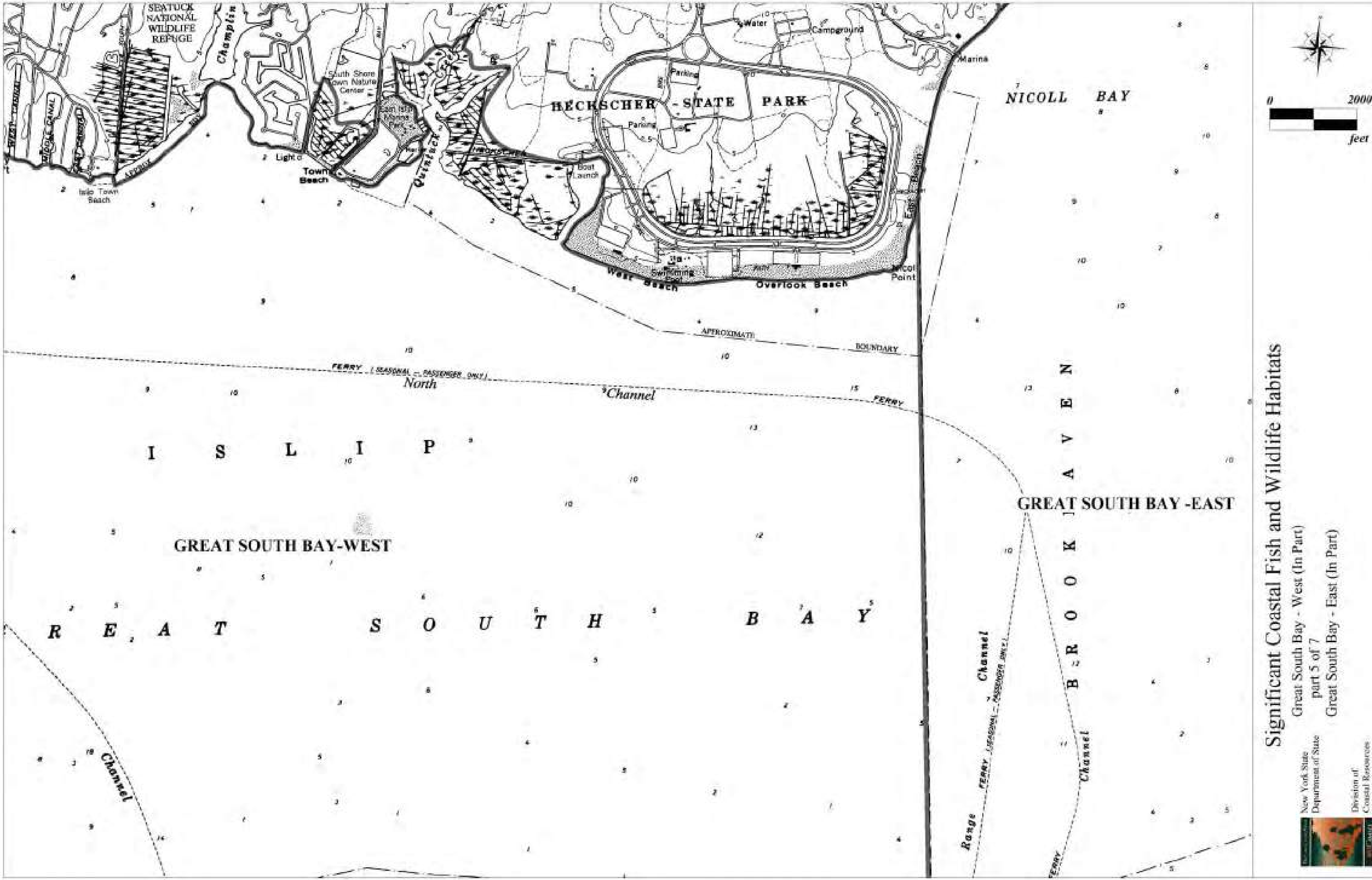
Significant Coastal Fish and Wildlife Habitats
Great South Bay - West (In Part) part 1 of 7
Jones Beach East
South Oyster Bay (In Part)
Tobay Sanctuary (In Part)
New York State Department of State
Division of Coastal Resources
0
2000
feet
GREAT SOUTH BAY-WEST
GREAT SOUTH BAY
JONES BEACH EAST
SOUTH OYSTER BAY
TOBAY SANCTUARY
ATLANTIC
BABYLON MARSH
STATE TIDAL WETLANDS
GILGO STATE PARK
Cedar Island
Gilgo Island
Thatch Island
Hemlock Cove
Tidal Flat
Cedar Beach
Amityville Cut
SUFFOLK CO
NASSAU CO
Unqua Pt
Copiague Neck
COUNTY PARK
Strongs Point
Howell Point
Tanner Park
Municipal Dock
Swimming Pool
Golf Course
Parking
Gilgo Beach
BABYLON

Significant Coastal Fish and Wildlife Habitats
Great South Bay - West(In Part)
part 2 of 7
Jones Beach East (In Part)
Democrat Point (In Part)
New York State Department of State
Division of Coastal Resources
0
2000
feet
G R E A T S O U T H B A Y
GREAT SOUTH BAY-WEST
JONES BEACH EAST
DEMOCRAT POINT
F I R E I S L A N D
Little Neck
Strongs Point
Bergen Point
Santapogue Point
Sampawams Pt
APPROXIMATE BOUNDARY
Grass Island
Oak Island
Cedar Island
Oak Beach
Tidal Flat
Golf Course
Parking
Cedar Overlook Beach
Cedar Beach
Democrat
Light

Significant Coastal Fish and Wildlife Habitats
Great South Bay - West (In Part)
part 3 of 7
New York State Department of State
Division of Coastal Resources
0
2000
feet
GREAT SOUTH BAY-WEST
SOUTH BAY
G R
Babylon Cove
Conklin Point
Willetts Point
West Islip Town Beach and Marina Park
Sampawams Pt
BOUNDARY
Oak Neck
Sequatogue Neck
GARDINERS COUNTY PARK
H J ISBRANDTSEN STATE TIDAL WETLANDS
Good Samaritan Hospital
Library
Dickerson Channel
West
Snakehill Channel
Sand Island
Grass Island
Captree Island
Captree
Island
Sexton Island
Seganus Thatch
APPROXIMATE
CAUSEWAY
ROBERT MOSES
Light



Significant Coastal Fish and Wildlife Habitats
Great South Bay - West(In Part)
part 4 of 7
New York State Department of State
Division of Coastal Resources
0
2000
feet
GREAT SOUTH BAY-WEST
I S L I P
G R E A T S O U T H
SEATUCK NATIONAL WILDLIFE REFUGE
HECKSCHER STATE
Great Cove
Penataquit Pt
Bay Shore Marina Park
Brightwaters
Bayberry Pt
Islip Town Beach
Champlin
South Shore Town Nature Center
Town Beach
Boat Launch
West Beach
Swimming Pool
Parking
H. J. ISBRANDTSEN STATE TIDAL WETLANDS
Lawrence Lake
Mirror Lake
Cascade Lakes
Orowoc
Quintuck
Neck
North Channel
FERRY (SEASONAL - PASSENGER ONLY)
West Channel
FERRY
Dickerson Channel
Dickerson Channel
Light

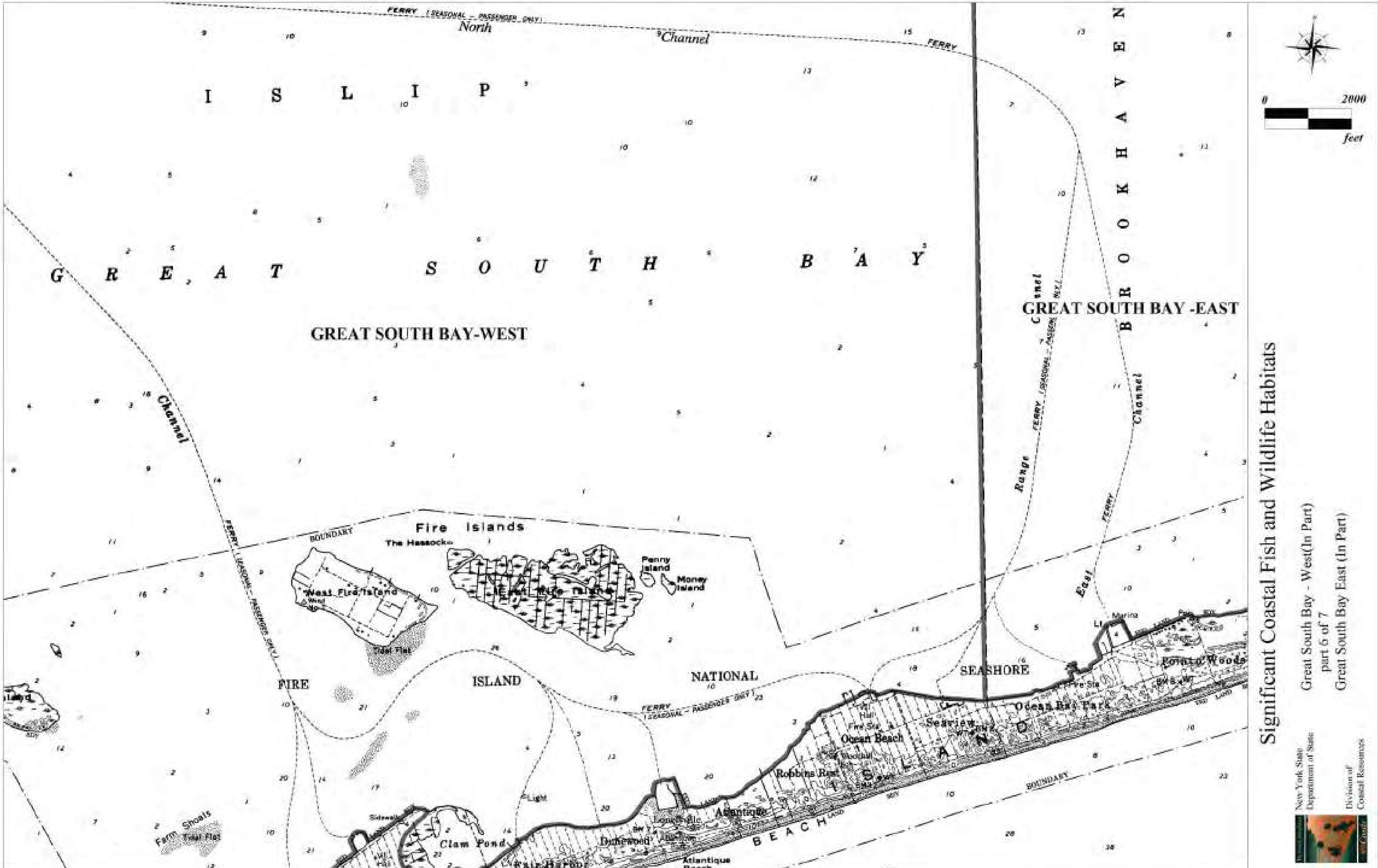


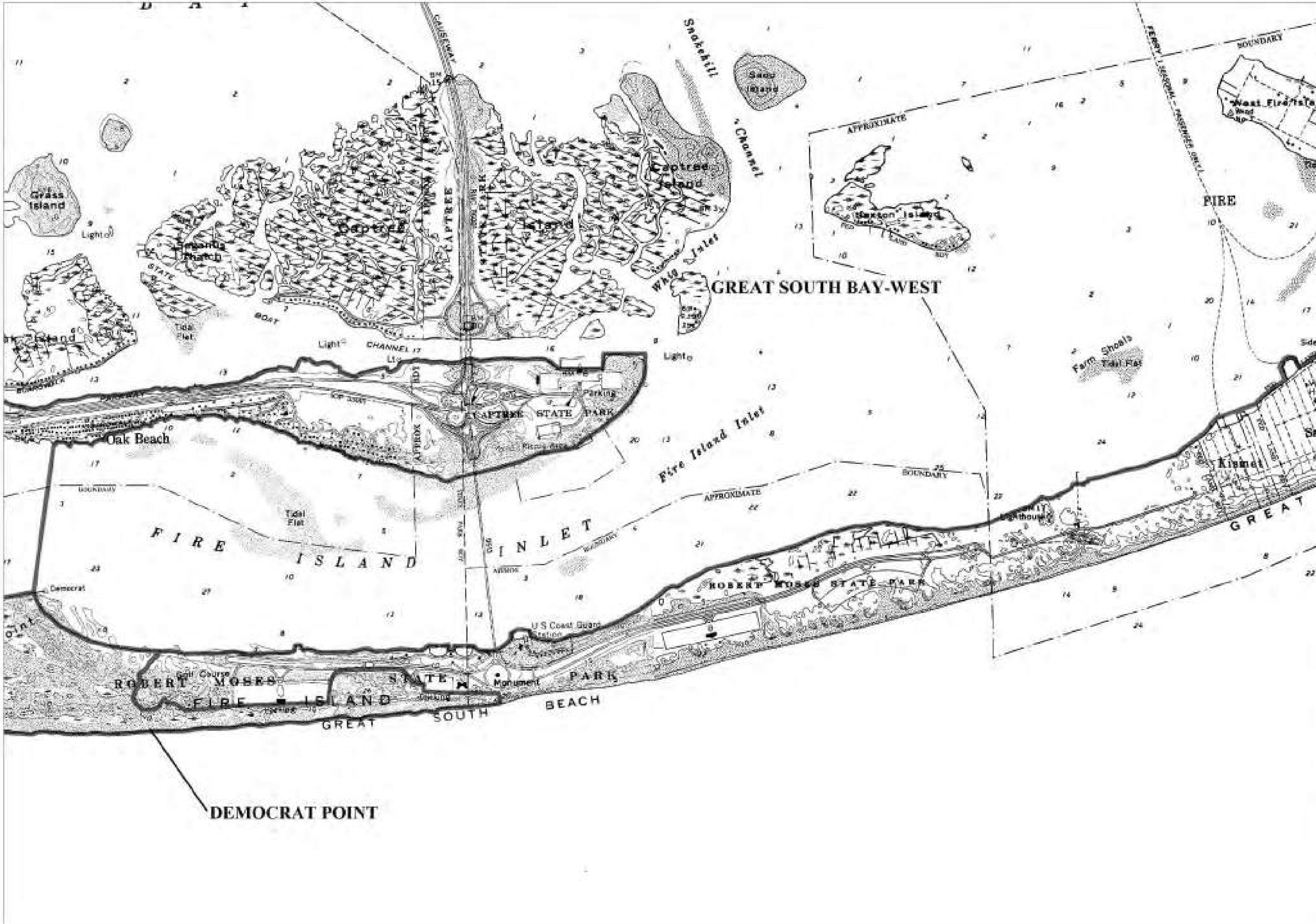
Significant Coastal Fish and Wildlife Habitats

Great South Bay - West (In Part)
part 5 of 7
Great South Bay - East (In Part)

New York State Department of State

Division of Coastal Resources


Significant Coastal Fish and Wildlife Habitats
Great South Bay - West(In Part)
part 6 of 7
Great South Bay East (In Part)
New York State Department of State
Division of Coastal Resources
0
2000
feet
GREAT SOUTH BAY-WEST
GREAT SOUTH BAY -EAST
I S L I P
B R O O K H A V E N
G R E A T S O U T H B A Y
North Channel
FERRY (SEASONAL - PASSENGER ONLY)
Fire Islands
The Hassocks
West Fire Island
East Fire Island
Penny Island
Money Island
Tidal Flat
FIRE ISLAND NATIONAL SEASHORE
Range Channel
East Channel
BOUNDARY
Clam Pond
Fair Harbor
Dunewood
Lonelyville
Atlantique
Atlantique Beach
Robbins Rest
Ocean Beach
Seaview
Ocean Bay Park
Point O' Woods
Marina
Farm Shoals
Light
BEACH



Significant Coastal Fish and Wildlife Habitats

Great South Bay - West (In Part)
part 7 of 7
Democrat Point (In Part)

New York State Department of State
Division of Coastal Resources

In the matter of a Significant Coastal Fish and Wildlife Habitat area in the
Town of Islip, Suffolk County, State of New York

<u>Orowoc Creek</u>

I, Lorraine A. Cortés- Vásquez, Secretary of State, based upon the recommendations of the New York State Department of Environmental Conservation, consultation with other appropriate State and local agencies, and after reviewing the public hearing record, do hereby repeal the March 15, 1987 designation of Orowoc Creek as a Significant Coastal Fish and Wildlife Habitat area pursuant to sections 912 and 913 of the Executive Law and Parts 600 and 602 of 19 NYCRR.

1. Reasons for this prior designation included: its rarity in this ecological region as a relatively clean, cold, freshwater stream; a recreational salmonid fishery of county-level significance; and a naturally reproducing brook trout population. This designation was reconsidered given the most current documentation. Increased development adjacent to Orowoc Creek has dried up the headwaters and led to increasing storm water inputs. Due to the water quality impairments, Orowoc Creek no longer provides suitable conditions for or supports viable brook trout populations.

2. This area no longer satisfies the criteria of 19 NYCRR Section 602.5; and,

3. The repeal is justified by changes to the characteristics of the area which were the basis for the original designation and the coastal area map will be amended accordingly.

In addition, and based on the above findings, the existing boundary of this habitat will be removed from the Coastal Boundary map as depicted on the amended map (Attachment A).

Dated: August 28, 2008

Secretary of State

In the matter of a Significant Coastal Fish and Wildlife Habitat area in the
Town of Islip, Suffolk County, State of New York

Champlin Creek

I, Lorraine A. Cortés- Vásquez, Secretary of State, based upon the recommendations of the New York State Department of Environmental Conservation, consultation with other appropriate State and local agencies, and after reviewing the public hearing record, do hereby repeal the March 15, 1987 designation of Champlin Creek as a Significant Coastal Fish and Wildlife Habitat area pursuant to sections 912 and 913 of the Executive Law and Parts 600 and 602 of 19 NYCRR, based on the following findings:

1. Reasons for Champlin Creek's prior designation included its rarity in this ecological region as a relatively clean, cold, freshwater stream; a recreational salmonid fishery of county-level significance; and a naturally reproducing brook trout population. This designation was reconsidered given the most current documentation. Increased development adjacent to Champlin Creek has dried up the headwaters and led to increasing storm water inputs. Due to the water quality impairments, Champlin Creek no longer provides suitable conditions for or supports populations of brook trout for which it was originally designated.

2. This area no longer satisfies the criteria of Executive Law § 912 (3) and 19 NYCRR Section 602.5; and,

3. The repeal is justified by changes to the characteristics of the area which were the basis for the original designation and the coastal area map will be amended accordingly.

In addition, and based on the above findings, the existing boundary of this habitat will be removed from the Coastal Boundary map as depicted on the amended map (Attachment A).

Dated: August 28, 2008

Lorraine Cortés-Vásquez

Secretary of State

APPENDIX C

SHELLFISH CLOSURE AREA INFORMATION

(2) Town of Islip.

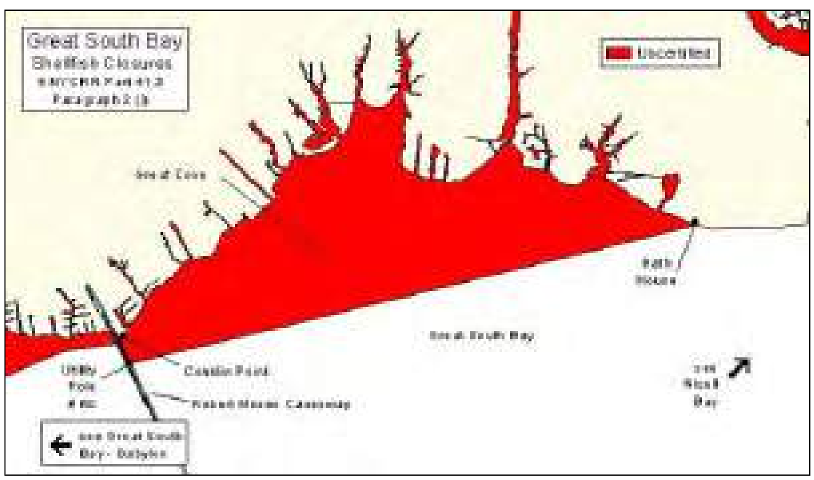
Great South Bay
Patchogue Bay

(i) Great South Bay.

(a) All that area of Great South Bay, including tributaries, creeks and canals, lying north of a line extending southwesterly from the southernmost point of land at Conklin Point (immediately east of the northern end of the twin spans of the Robert Moses Causeway) to light pole number 103 (second aluminum light pole south of the base of the bridge on the west side of the west span, approximately 200 yards south of the base of the bridge and adjacent to the 14th bridge support south of the shoreline on the west span); thence proceeding westerly to the southernmost point of land at Sampawams Point; and, all that area of Great South Bay lying north of a line extending southwesterly from the northern concrete base of the twin spans of the Robert Moses Causeway to a point of intersection located 900 yards southwest of Bergen Point and 900 yards southeast of the mouth of the Neguntatogue Creek; thence proceeding westerly to a point of intersection located 900 yards southeast of Unqua Point (Nassau Shores); thence proceeding westerly to the southeasternmost tip of Goose Island (South Oyster Bay).

*(also see: Great South Bay - Babylon/Islip Conditional Program) That portion of Great South Bay designated as a conditional area remains uncertified when there is no conditional program in effect, and during any period when the conditional program is in the "closed" status.

(b) All that area of Great South Bay, including tributaries, creeks, and canals, lying easterly of a line extending southerly from the northernmost point of land at the base of the eastern span of the Robert Moses Causeway to light pole number 60 (sixth aluminum light pole south of the base of the bridge on the east side of the east span); and all that area lying northerly of a line extending easterly from light pole number 60 on the eastern span of Robert Moses Causeway to the southwesternmost corner of the bath house serving the west bathing area at Heckscher State Park (located east of the entrance to the boat basin at Heckscher State Park).



(c) All creeks and canals lying between Nicoll Point and Timber Point.

(d) (1) During the period May 1 through December 14 (both dates inclusive), all that area of Nicoll Bay, Connetquot River, Brickiln Creek (local name) and tributary creeks and canals between Nicoll Point and Blue Point lying north of a line extending easterly from the southern side of the entrance to the creek serving the Timber Point West Marina and the Suffolk County Marine Police Boat Basin (said creek is located on the eastern side of Nicoll Point) to a point of intersection located 1250 yards southeast of the southeasterly corner of the town dock at the foot of West Avenue in West Sayville (local landmark); thence continuing northeasterly to a point of intersection located 250 yards south of Blue Point; and thence continuing northerly to the southeasternmost point of land at Blue Point.

(2) During the period January 1st through December 31st, both dates inclusive, all that area of Great South Bay, Nicoll Bay, Connetquot River and tributary creeks and canals and all of Brickiln Creek and tributary creeks and canals lying north of a line extending northeasterly from the easternmost tip of Timber Point to the southernmost tip of Nicoll Island (located immediately east of Timber Point), thence continuing northeasterly along the southern shoreline of said island to its easternmost extremity and thence continuing northeasterly to the western extremity of the hedgerow separating the properties of St. John's University - Eastern Long Island (Oakdale) Campus (formerly La Salle) from the West Oak Recreation Club (WORC) at Oakdale (local landmarks).

(3) During the period January 1st through December 31st,both dates inclusive, all that area of Great South Bay, Nicoll Bay and tributary creeks and canals within 500 feet in any direction from the bulkhead protecting the shoreline on the southern side of the entrance to the western branch of Indian Creek (local name, said creek is located on the western side of Green Point, approximately 750 yards north of the southernmost point of land at Green Point).

(4) During the period January 1st through December 31st, both dates inclusive, all that area lying north of a line extending easterly from the southeasterly corner of the town dock at the foot of West Avenue in West Sayville (local landmark) to the southeasternmost corner of the bulkheaded breakwater forming the entrance to Green Creek, West Sayville (local landmark).

(5) During the period January 1st through December 31st, both dates inclusive, all that area of Great South Bay and Brown Creek (Browns River) lying 500 feet easterly and westerly from the southern end of the jetties protecting the entrance to Brown Creek and extending 1000 feet southerly of the entrance to said creek.

(e) All rivers, creeks, canals and boat basins between Timber Point and Blue Point.

(f) During the period May 15th through September 30th, both dates inclusive, all that area lying 500 feet easterly and westerly of the bulkheads forming the entrance to the harbor serving Fire Island Pines and extending 1,000 feet northerly of the entrance to said harbor.

(g) (1) All that area adjacent to the shore of Fire Island at Ocean Beach south of a line extending northeasterly from the northeastern corner of the building housing Maguires Restaurant on Bungalow Walk at Ocean Beach (local landmark) to Channel Buoy C "15" and continuing southeasterly to Channel Buoy C "17", and thence southerly to the water tank at Sea View.

(2) During the period May 15 through September 30, both dates inclusive, all that area of Great South Bay adjacent to Alantique, Ocean Beach and Ocean Bay Park lying east of a line extending northerly from the western side of the entrance of the boat basin at Alantique to the easternmost point of land at East Fire Island; south of a line extending easterly from the easternmost point of land at East Fire Island to Buoy GC "1" (Range Channel); and west of a line extending southeasterly from Buoy GC "1" to the east side of the entrance to the boat basin at Ocean Bay Park.

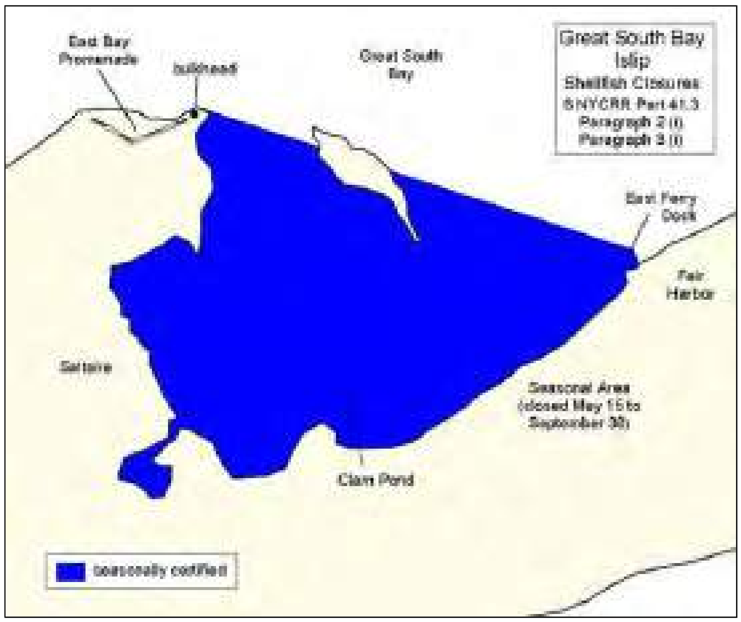
(h) During the period May 15 through September 30, both dates inclusive, all that area adjacent to Sailors Haven lying within an area extending 1,000 feet northerly of the entrance to the boat basin at Sailors Haven and extending 500 feet easterly and westerly of the entrance to said boat basin.

(i) During the period May 15 through September 30, both dates inclusive, all that area adjacent to Barrett Beach lying within an area extending 1,000 feet northerly of the entrance to the boat basin at Barrett Beach and extending 500 feet easterly and westerly of the entrance to said boat basin.

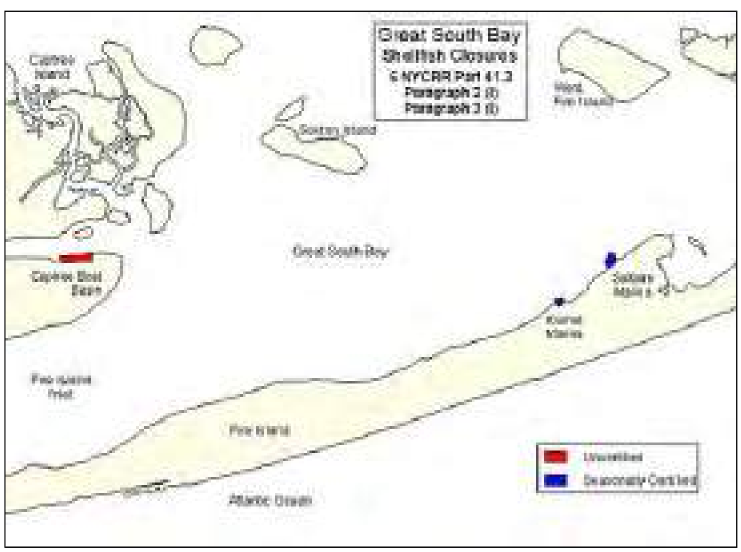
(j) During the period May 15 through September 30, both dates inclusive, all that area adjacent to Cherry Grove within the boundaries of a line extending northeasterly from the westernmost end of the wooden bulkhead protecting the shoreline at Cherry Grove (local landmark) to Channel Buoy R "4" Fl R 4 sec and then continuing southeasterly to the easternmost end of the wooden bulkhead protecting the shoreline at Cherry Grove (local landmark).

(k) During the period May 15 through September 30, both dates inclusive, all that area within the Town of Islip Marina - Boat Basin (local name), Flynn's Marina - Boat Basin (local name), the Saltaire Marina - Boat Basin (local name), and the Kismet Inn Marina - Boat Basin (local name). Said marina - boat basins are tributaries of Great South Bay along the shoreline of Fire Island.

(l) During the period May 15 through September 30, both dates inclusive, all that area of Clam Pond (local name) in and adjacent to the Village of Saltaire, lying southerly of a line extending southeasterly from the northernmost corner of the bulkhead protecting the property and residence located at the easternmost end of East Bay Promenade, Saltaire, to the northwesternmost corner of the eastern ferry dock at Fair Harbor; thence proceeding southerly along the eastern side of the dock to the shoreline at Fair Harbor.



(m) All that area of the marina boat basin, including entrance canal, at Captree State Park.



(ii) Patchogue Bay.

(a) All that area of Great South Bay, Patchogue Bay and tributaries lying northerly of a line extending easterly from the southernmost point of land at Blue Point to the southeastern corner of the southeasternmost residence on Rod Street, approximately 100 yards southeast of the foot of Dunton Avenue, West Bellport (said residence is a two story house, white brick and light grey shingle, with light grey roof).

*(also see: Patchogue Bay Conditional Program) That portion of Patchogue Bay designated as a conditional area remains uncertified when there is no conditional program in effect, and during any period when the conditional program is in the "closed" status.

(b) During the period May 1 through December 14, both dates inclusive, all that area of Great South Bay, Patchogue Bay and tributaries within 500 yards in any direction from the foot of Dunton Avenue, West Bellport.

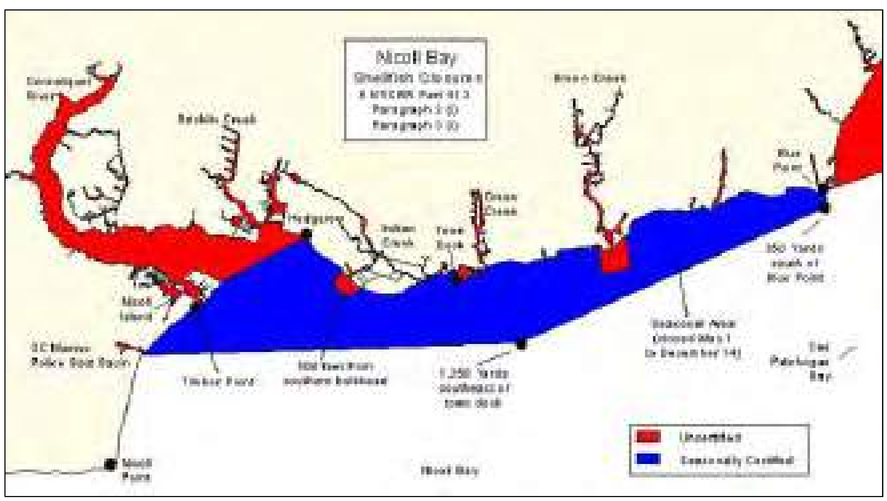
Note: All reference points, except local names or local landmarks are taken from N.O.A.A. Nautical Chart No. 12352, 20th Edition, dated November 27, 1982.

(3) Town of Brookhaven (South Shore).

Great South Bay
Patchogue Bay
Bellport Bay
Narrow Bay
Moriches Bay

(i) Great South Bay.

(a) All rivers, creeks, canals and boat basins between Nicoll Point and Howells Point.



(b) (1) During the period May 1 through December 14 (both dates inclusive), all that area of Nicoll Bay, Connetquot River, Brickiln Creek, (local name) and tributary creeks and canals lying north of a line extending easterly from the southern side of the entrance to the creek serving the Timber Point West Marina and the Suffolk County Marine Police Boat Basin (said creek is located on the eastern side of Nicoll Point) to a point of intersection located 1250 yards southeast of the southeasterly corner of the town dock at the foot of West Avenue in West Sayville (local landmark); thence continuing northeasterly to a point of intersection located 250 yards south of Blue Point; and thence continuing northerly to the southeasternmost point of land at Blue Point.

(2) During the period January 1st through December 31st, both dates inclusive, all that area of Great South Bay, Nicoll Bay, Connetquot River and tributary creeks and canals and all of

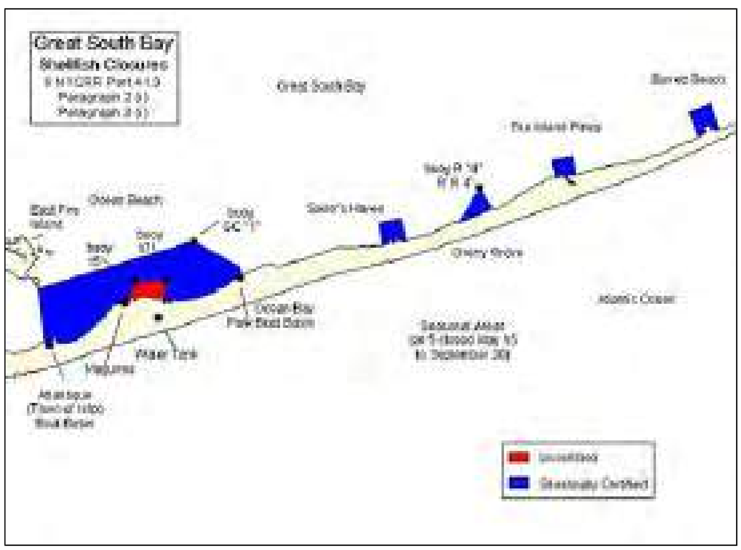
Brickiln Creek and tributary creeks and canals lying north of a line extending northeasterly from the easternmost tip of Timber Point to the southernmost tip of Nicoll Island (located immediately east of Timber Point), thence continuing northeasterly along the southern shoreline of said island to its easternmost extremity and thence continuing northeasterly to the western extremity of the hedgerow separating the properties of St. John's University - Eastern Long Island (Oakdale) Campus (formerly LaSalle) from the West Oak Recreation Club (WORC) at Oakdale (local landmarks).

(3) During the period January 1st through December 31st, both dates inclusive, all that area of Great South Bay, Nicoll Bay and tributary creeks and canals within 500 feet in any direction from the bulkhead protecting the shoreline on the southern side of the entrance to the western branch of Indian Creek (local name, said creek is located on the western side of Green Point, approximately 750 yards north of the southernmost point of land at Green Point).

(4) During the period January 1st through December 31st, both dates inclusive, all that area lying north of a line extending easterly from the southwesterly corner of the town dock at the foot of West Avenue in West Sayville (local landmark) to the southeasternmost corner of the bulkheaded breakwater forming the entrance to Green Creek, West Sayville (local landmark).

(5) During the period January 1st through December 31st, both dates inclusive, all that area of Great South Bay and Brown Creek (Browns River) lying 500 feet easterly and westerly from the southern end of the jetties protecting the entrance to Brown Creek and extending 1000 feet southerly of the entrance to said creek.

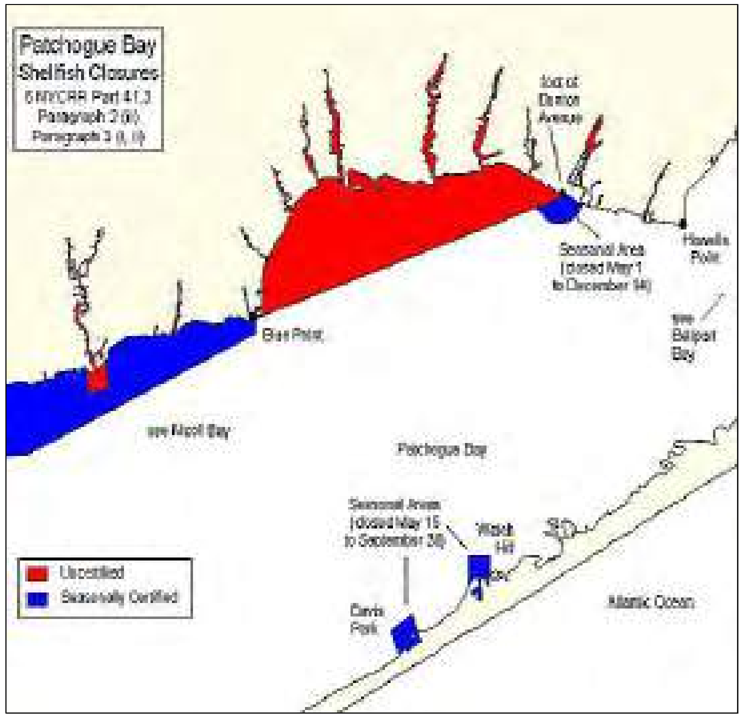
(c) During the period May 15 through September 30th, both dates inclusive, all that area lying 500 feet easterly and westerly of the bulkheads forming the entrance to the harbor serving Fire Island Pines and extending 1,000 feet northerly of the entrance to said harbor.



(d) During the period May 15 through September 30, both dates inclusive, all that area adjacent to Sailors Haven lying within an area extending 1,000 feet northerly of the entrance to the boat basin at Sailors Haven and extending 500 feet easterly and westerly of the entrance to said boat basin.

(e) During the period May 15 through September 30, both dates inclusive, all that area adjacent to Barrett Beach lying within an area extending 1,000 feet northerly of the entrance to the boat basin at Barrett Beach and extending 500 feet easterly and westerly of the entrance to said boat basin.

(f) During the period May 15 through September 30, both dates inclusive, all that area adjacent to Davis Park lying within an area extending 1,000 feet northerly of the entrance to the harbor serving Davis Park and extending 500 feet easterly and westerly of the entrance to said harbor.



(g) During the period May 15 through September 30, both dates inclusive, all that area adjacent to Watch Hill lying within an area extending 1,000 feet northerly of the entrance to the harbor serving Watch Hill and extending 500 feet easterly and westerly of the entrance to said harbor.

(h) During the period May 15 through September 30, both dates inclusive, all that area adjacent to Cherry Grove within the boundaries of a line extending northeasterly from the westernmost end of the wooden bulkhead protecting the shoreline at Cherry Grove (local landmark) to Channel Buoy R "4" Fl R 4 sec and then continuing southeasterly to the easternmost end of the wooden bulkhead protecting the shoreline at Cherry Grove (local landmark).

(i) During the period May 15 through September 30, both dates inclusive, all that area within the Town of Islip Marina - Boat Basin (local name), Flynn's Marina - Boat Basin (local name), the Saltaire Marina - Boat Basin (local name), and the Kismet Inn Marina - Boat Basin (local name). Said marina - boat basins are tributaries of Great South Bay along the shoreline of Fire Island.

(j) During the period May 15 through September 30, both dates inclusive, all that area of Clam Pond (local name) in and adjacent to the Village of Saltaire, lying southerly of a line extending southeasterly from the northernmost corner of the bulkhead protecting the property and residence located at the easternmost end of East Bay Promenade, Saltaire, to the northwesternmost corner of the eastern ferry dock at Fair Harbor; thence proceeding southerly along the eastern side of the dock to the shoreline at Fair Harbor.

(ii) Patchogue Bay.

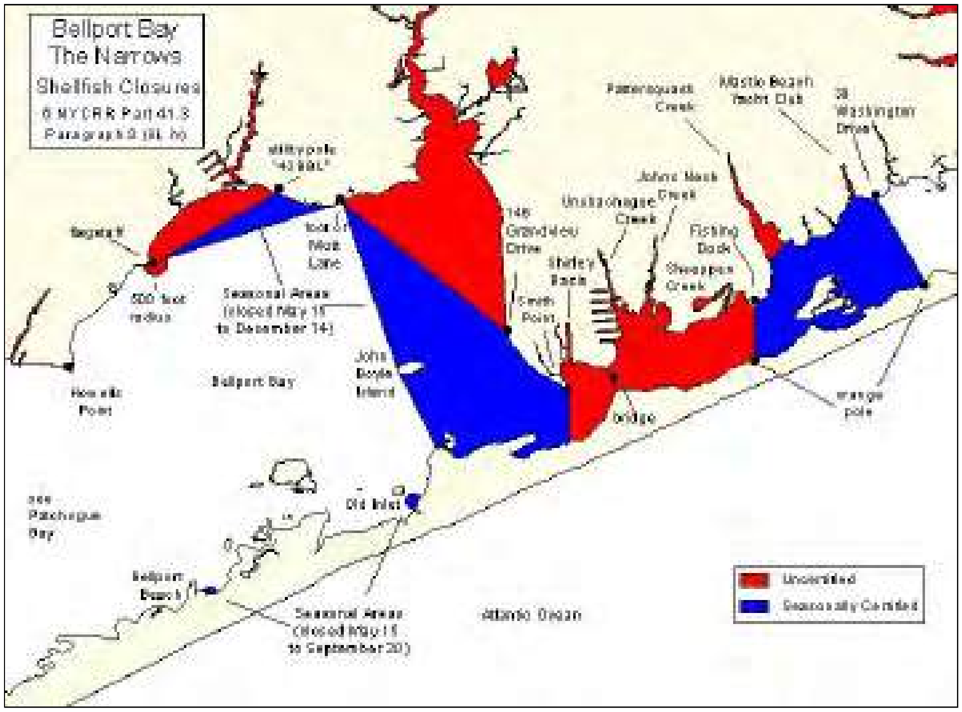
(a) All that area of Great South Bay, Patchogue Bay and tributaries lying northerly of a line extending easterly from the southernmost point of land at Blue Point to the southeastern corner of the southeasternmost residence on Rod Street, approximately 100 yards southeast of the foot of Dunton Avenue, West Bellport (said residence is a two story house, white brick and light grey shingle, with light grey roof).

*(also see: Patchogue Bay Conditional Program) That portion of Patchogue Bay designated as a conditional area remains uncertified when there is no conditional program in effect, and during any period when the conditional program is in the "closed" status.

(b) During the period May 1 through December 14, both dates inclusive, all that area of Great South Bay, Patchogue Bay and tributaries within 500 yards in any direction from the foot of Dunton Avenue, West Bellport.

(iii) Bellport Bay.

(a) All that area of Bellport Bay, including tributaries, lying northerly of a line extending northeasterly from the flagstaff serving the Bellport Yacht Club, located at the foot of Bellport Lane in Bellport, to utility pole No. "43BBL", located at the foot of Bay Avenue (Bay Road) at Fireplace Neck (local landmark).



(b) All that area of Bellport Bay within a 500-foot radius of the flagstaff serving the Bellport Yacht Club located at the foot of Bellport Lane in Bellport.

(c) During the period May 15 through December 14, both dates inclusive, all that area of Bellport Bay, lying north of a line extending east from the from the flagstaff serving the Bellport Yacht Club, located at the foot of Bellport Lane in Bellport, to the foot of Mott Lane (Gorman Lane), at Fireplace Neck, and south of a line drawn from the flagstaff serving the Bellport Yacht Club, located at the foot of Bellport Lane in Bellport, to utility pole No. "43BBL", located at the foot of Bay Avenue (Bay Road) at Fireplace Neck (local landmark).

(d) All that area of Bellport Bay, Carmans River and tributaries lying northerly of a line extending southeasterly from the Foot of Mott Lane (Gorman Lane), at Fireplace Neck, to the residence at 146 Grandview Drive in Shirley (local landmark, such residence is the southernmost house on the west side of Smith Point).

(e) All that area of Bellport Bay, including Shirley Basin, the entrance to Narrow Bay and tributaries, lying easterly of a line extending due south (magnetic) from the southernmost point of land at Smith Point to the opposite shoreline of the barrier beach.

(f) During the period May 15 through September 30, both dates inclusive, all that area of Bellport Bay within 100 yards in any direction from the marina area docks at Bellport Beach and Old Inlet.

(g) During the period May 15th through December 14th, both dates inclusive, all that area of Bellport Bay, including tributaries, lying north and east of a line extending southerly from the foot of Mott Lane (Gorman Lane) at Fireplace Neck to the westernmost point of land at John Boyle Island (local landmark); thence continuing southerly to the northwesternmost point of land east of the dock at Old Inlet.

(iv) Narrow Bay.

(a) During the period January 1st through December 31st, both dates inclusive, all creeks, canals, coves and tributaries, including Shirley Basin, Unchachogue Creek, Johns Neck Creek, Sheeppen Creek (Section 5 Marina), Pattersquash Creek, and Mastic Beach Yacht Club Canal (Section 1 Marina), located along the shoreline between Smith Point and Floyd Point (local names, local landmarks).

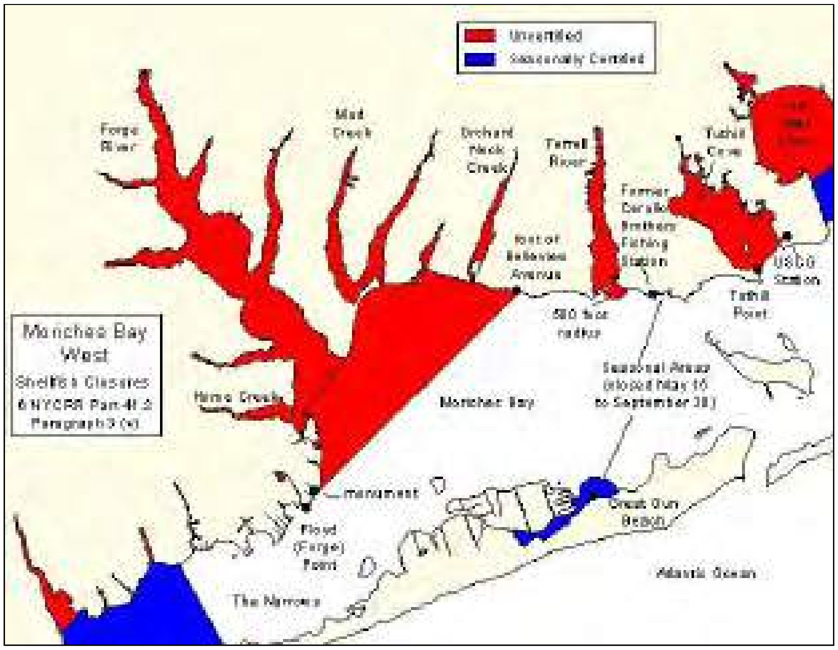
(b) During the period January 1st through December 31st, both dates inclusive, all that area of Narrow Bay and its tributaries lying westerly of a line extending southerly from the westernmost point of the landward side of the public fishing dock located at the foot of Cranberry Drive, Mastic Beach (local name, local landmark) to an orange painted wood marker located on the opposite southern shoreline (local landmark).

(c) During the period January 1st through December 31st, both dates inclusive, all that area of Narrow Bay lying northerly of a line extending easterly from the northeastern corner of the residence at 542 Riviera Drive, Mastic Beach (said residence is a two-story structure painted dark green with a tan-colored turret) to the northwestern corner of the residence at 205 Riviera Drive, Mastic Beach (said residence is a pink two-story structure located at the intersection with Locust Drive; local names, local landmarks).

(d) During the period April 15th to December 31st, both dates inclusive, all that area of Narrow Bay and its tributaries lying easterly of a line extending southerly from the westernmost point on the landward side of the public fishing dock located at the foot of Cranberry Drive, Mastic Beach (local landmark) to an orange painted wood marker located on the opposite southern shoreline (local landmark); AND westerly of a line extending southerly from the tip of the gable of the residence at 39 Washington Drive (said residence is located on the western side of the southern foot of Washington Drive, Mastic Beach; local names, local landmarks) to an orange painted wood marker located on the opposite southern shoreline (local landmark).

(v) Moriches Bay.

(a) All that area, including Home Creek, Forge River, Old Neck Creek, Mud Creek, Areskonk Creek, Orchard Neck Creek and all other creeks, canals, rivers and coves, north of a line extending northeasterly from the monument located near the shoreline at the southeastern tip of Forge Point (said monument is a wooden pole painted orange, located approximately 1,000 yards south of the entrance to Home Creek, local landmark) to the foot of Belleview Avenue, Center Moriches (local name).



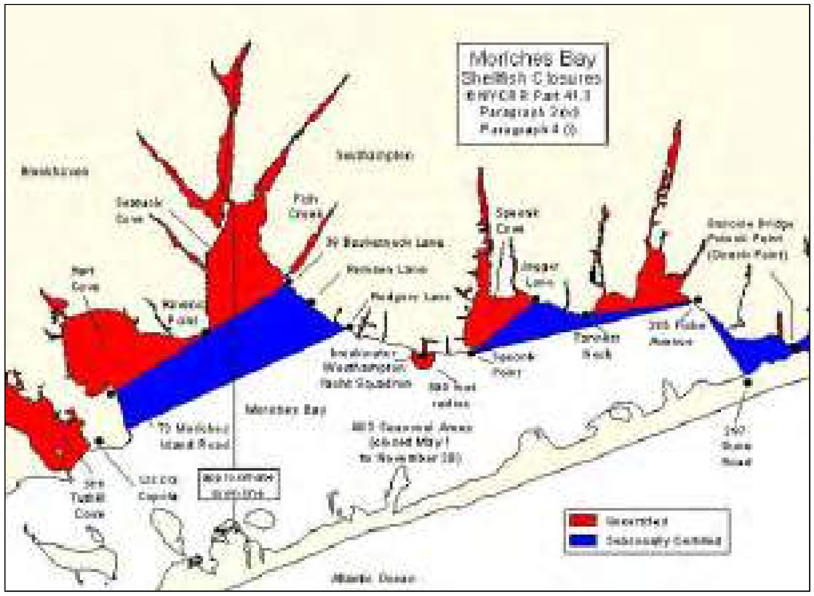
(b) All that area of Moriches Bay within 500 feet of the Terrell River mouth and all of the Terrell River.

(c) All that area of Tuthill Cove and tributaries north of a line extending northeasterly from the easternmost tip of Tuthill Point to the cupola located on the roof of the Moriches Coast Guard Station (local landmark).

(d) During the period May 15th through September 30th, both dates inclusive, all that area of the boat basin formerly known as Cerullo Brothers Fishing Station, East Moriches (local name).

(e) During the period May 15th to September 30th, both dates inclusive, all that area lying within 500 feet from any portion of the bulkheading and fixed or floating dock structures at the Town of Brookhaven, Great Gun Beach (local name), and all the adjacent unnamed cove lying approximately 300 yards southwest of the westernmost end of the bulkheading at Great Gun Beach.

(f) During the period January 1st through December 31st, both dates inclusive, all that area, including Hart Cove, Seatuck Cove and all other creeks, canals, rivers and coves, lying north of a line extending northeasterly from the northeastern corner of the residence at #73 Moriches Island Road (said residence is located approximately 100 yards north of the foot of Moriches Island Road, East Moriches, Town of Brookhaven) to the southernmost point of land at Havens Point and thence continuing to the flagpole located at the residence at #39 Basketneck Lane (local landmark; said residence is located approximately 100 yards southeast of the entrance to Fish Creek on the eastern shoreline of Seatuck Cove, Town of Southampton).



*(also see: Moriches Bay/Seatuck Cove Conditional Program) That portion of Seatuck Cove designated as a conditional area remains uncertified when there is no conditional program in effect, and during any period when the conditional program is in the "closed" status.

(g) During the period May 1 through November 30, both dates inclusive, all that area of Moriches Bay lying north of a line extending northeasterly from the cupola located on the roof of the Moriches Coast Guard Station (located within the Town of Brookhaven) to the foot of Rodgers Lane, Remsenburg (local name, local landmark).

Note: All reference points in the Town of Brookhaven (South Shore) are taken from N.O.A.A. Nautical Chart No. 12352, 22nd Ed., dated May 11, 1985, except as indicated as "local landmark" or "local name".

APPENDIX D

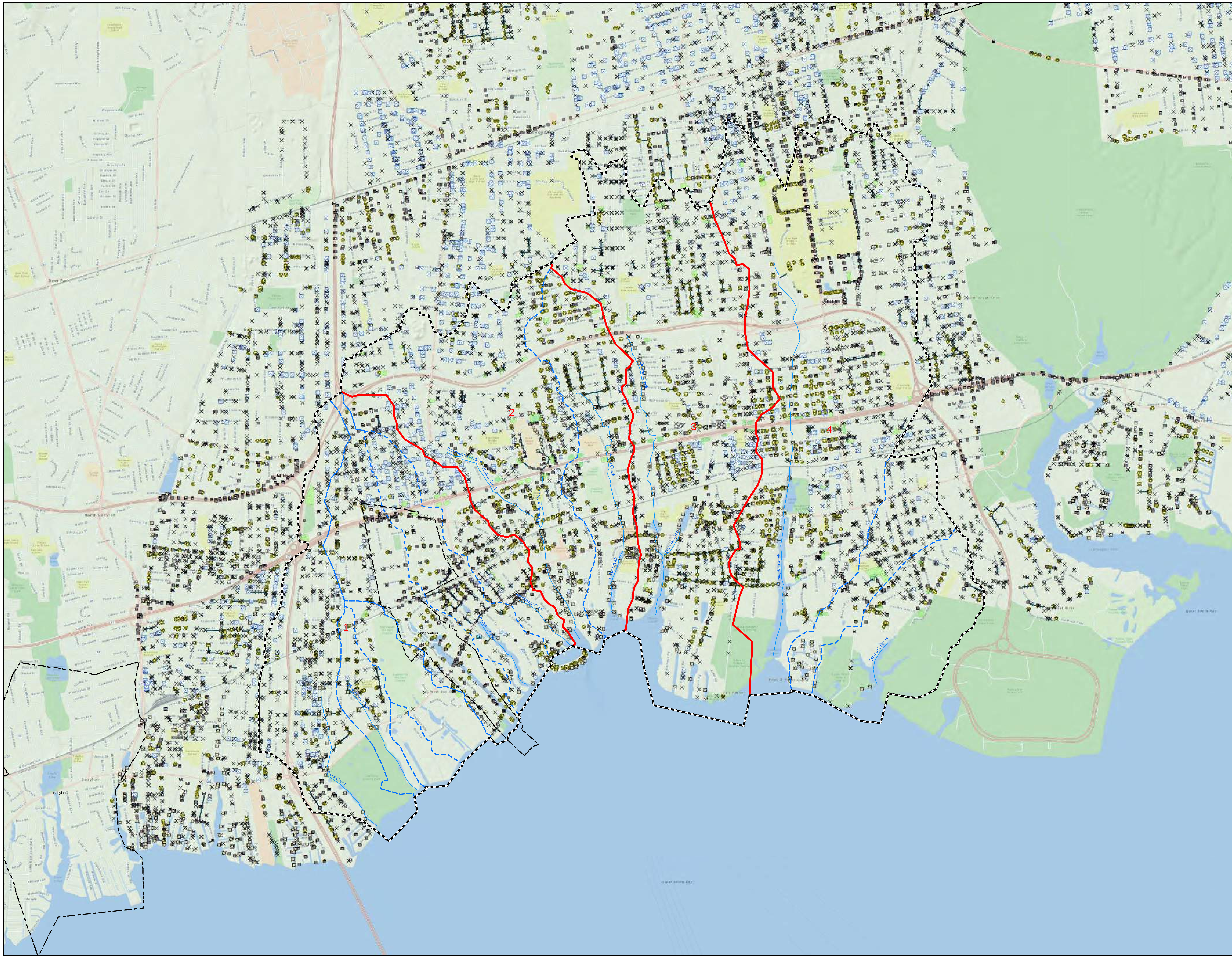
STORMWATER INFRASTRUCTURE MAP

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE GREAT COVE WATERSHED

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010



Legend

- Great Cove Overall Watershed Boundary
- Sub-Areas
- Individual Watershed Boundaries
- Stream
- Recharge Basins

Drainage Infrastructure

- NA
- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- Other
- Drainage Piping
- Outfall

N

1 inch = 2,000 feet

Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting

APPENDIX E

PUBLIC OUTREACH AND EDUCATION MATERIALS

Your Waterways Needs You

The delicate ecological balance of Great Cove and adjoining Great South Bay have been upset by everyday human activities – fertilizing our lawns, flushing our toilets and driving our cars. The Town of Islip is working to address many of the stormwater problems that harm water quality, but this alone cannot restore the health of our waterways. All of our actions are responsible for the decline of our coastal waters, and it will take everyone's help to improve their health. Here are some suggestions:

✓ **FERTILIZE WISELY**
- Minimize use of fertilizers and pesticides, preferably non-toxic organic varieties (e.g., compost, horticultural oils, etc.).
- Avoid fertilizing within 100' of creeks, lakes, and bays.

✓ **MINIMIZE HARMFUL STORMWATER RUNOFF**
- Pick up after your dog.
- Clean up any spilled fertilizer or chemicals that fall on hard surfaces.
- Don't litter! Dumping unused chemicals, trash or yard waste into curbside storm sewers, drains or cesspools harms water quality.

✓ **RESTORE VEGETATED BUFFERS**
- Don't mow up to the water's edge.
- Maintain as wide of a natural buffer of trees, shrubs or wildflowers as possible (e.g., 100') between your lawn and a wetland to filter pollutants and shade creeks for fish.
- Try some of our native planting suggestions inside this pamphlet!

✓ **BE A "GREEN" BOATER**
- Empty vessel sanitary waste holding tanks at proper pump out facilities
- Use biodegradable cleaners on boats

Prepared by:
Nelson, Pope & Voorhis
572 Walt Whitman Road
Melville, NY 11747
Phone (631) 427-5665

A Resident's Guide To Keeping Great Cove… Great!

Great Cove
Islip, NY

Funded by:
NYS Department of State
and
Town of Islip
655 Main Street
Islip, NY 11751
(631) 224-5450

The Health of Great Cove and Great South Bay is Fragile

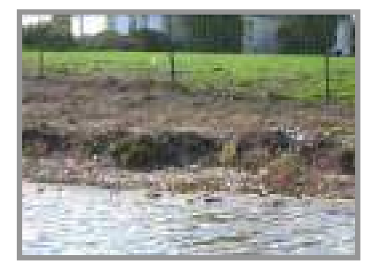
Islip is interconnected via its streams that feed into Great Cove and ultimately into Great South Bay. The Town's coastal waters provide valuable opportunities for recreational enjoyment, commercial fishing, and aesthetic appreciation. Unfortunately, our waterways have been compromised by pollutants from roadways, fertilizers from lawns, and historic impacts from septic systems before the area became sewered. These issues have caused problems with water quality, and on a few occasions, even fish die-offs.

Great Cove is home to several species of fish, shellfish, birds and waterfowl. Poor water quality has a severe impact on wildlife, as well as recreational and commercial activities.

Your Waterways Need Help

Many human activities (i.e. over-fertilization of lawns, pet waste, use of septic systems, wildfowl populations, impervious roadways) pollute the sensitive waters of creeks that flow into Great Cove and Great South Bay. Nutrient pollution comes from an overabundance of nitrogen and phosphorus entering the waterbody from our yards and runoff. Too many nutrients can cause an imbalance and lead to massive blooms of algae, which block sunlight from reaching underwater plants that provide food and shelter for wildlife. Dying algae also use up the dissolved oxygen in the water, resulting in less oxygen for fish and other wildlife, as well as impacting recreational activities due to unsightly residue and pungent odor.

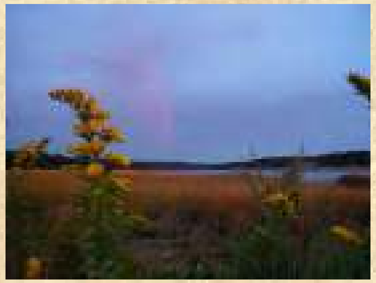
Primary sources of pollution are:
- Fertilizers and pesticides within close proximity to waterways.
- Stormwater from roads and parking lots, which sends lawn fertilizers, pet waste, sediments, pesticides, roadway grease and trash into storm drains and straight into waterways.
- Existing septic tanks and historic septic tanks that have since been replaced by sewers, but continue to have lasting impacts on groundwater that feeds into our streams.



You can help address some of these issues by restoring your native shoreline.

Habitats & Recommended Plantings

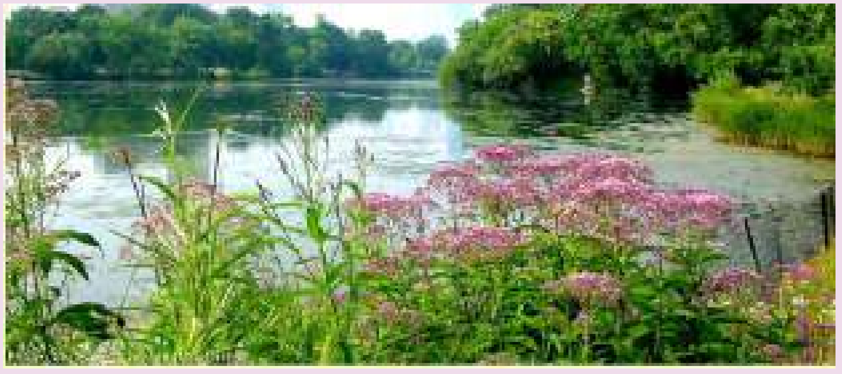
Dry Meadow – Butterfly Garden



Herbaceous Plants
Early Goldenrod *(Solidago juncea)*
Butterfly Milkweed *(Asclepias tuberosa)*
Blue Vervain *(Verbena hastata)*
New York Aster *(Symphyotricum novi-belgii)*
Wild Lupine *(Lupinus perennis)*
Boneset *(Eupatorium perfoliatum)*

Grasses
Switch Grass *(Panicum virgatum)*
Little Bluestem *(Shizachyrium scoparius)*
Big Bluestem *(Andropogon gerardii)*
Panicgrass *(Panicum amarum)*
Indiangrass *(Sorghastrum nutans)*
Purple Lovegrass *(Eragrostis spectabilis)*

Wet Meadow – Wetland Edge



Shrubs
Highbush Blueberry *(Vaccinium corymbosum)*
Swamp Rose *(Rosa palustris)*
Pussy Willow *(Salix discolor)*
Silky Dogwood *(Cornus amomum)*
Red-osier Dogwood *(Cornus sericea)*
Winterberry *(Ilex verticillata)*
Red Chokeberry *(Aronia arbutifolia)*
Buttonbush *(Cephalanthus occidentalis)*
Sweet Pepperbush *(Clethra alnifolia)*

Herbaceous Plants
Arrow Arum *(Peltandra virginica)*
Hop Sedge *(Carex lupulina)*
Soft Rush *(Juncus effusus)*
Swamp Milkweed *(Asclepias incarnata)*
Marsh Marigold *(Caltha palustris)*
Joe-Pye Weed *(Eupatorium dubium)*
Cardinal Flower *(Lobelia cardinalis)*
Monkey Flower *(Mimulus ringens)*
Beebalm *(Monarda didyma)*

Native Buffers can be Beautiful and Diverse!

Buffers are a band of protective vegetation along the edge of a body of water. Naturally occurring plants usually include trees, shrubs and tall, coarse grasses. This stretch of vegetation "buffers" waterways from harmful pollutants flowing across the landscape after a rainfall or snow melt. These non-point source pollutants also include eroded soil from poorly vegetated banks. Well-rooted vegetation holds the banks of the lake in place, stabilizing the soil. Roots also absorb water and some of the contaminants, while the above-ground portions of the plants slow the flow of polluted runoff, allowing the water to seep into the ground, where it is filtered and cleaned. Additionally, buffers provide food and habitat for a variety of wildlife, including birds, butterflies, and even fish when the plants drape over into the water.

To establish a buffer along your shoreline, you can choose from a wide variety of native plants to enhance the natural beauty of your landscape, provide food and habitat for wildlife, as well as help remediate the water quality of Great Cove and Great South Bay. Consider choosing plants from among these illustrated habitat types to achieve your desired look.

Planted buffers of up to 100 feet where possible are strongly encouraged and fertilization of lawns within 100 feet of wetlands is discouraged. Your efforts will help restore and protect our coastal waters.

Invasive Plants to Avoid

Common Reed *(Phragmites australis)*
Purple Loosestrife *(Lythrum salicaria)*
Running Bamboo *(Phyllostachys aurea)*
Japanese Barberry *(Berberis thunbergii)*
Burning Bush *(Euonymus alatus)*
Border Privet *(Ligustrum obtusifolium)*
Honeysuckles *(Lonicera japonica, L. mackii, L. morrowii, L. tatarica, L. bella, L. xylosteum.)*
Autumn Olive *(Eleagnus umbellata)*
Norway Maple *(Acer platanoides)*
Sycamore Maple *(Acer pseudoplatanus)*
Asiatic Bittersweet *(Celastrus orbiculatus)*
Porcelainberry *(Ampelopsis brevipedunculata)*
Myrtle *(Vinca minor)*

Woodland Plantings & Further Information

Woodland

Trees
Flowering Dogwood *(Cornus florida)*
Red Maple *(Acer rubrum)*
Red Chokeberry *(Aronia arbutifolia)*
Pin Oak *(Quercus palustris)*
Tuliptree *(Liriodendron tulipifera)*
Sweetbay Magnolia *(Magnolia virginiana)*
Black Gum *(Nyssa sylvatica)*
Sweetgum *(Liquidambar styracifolia)*
American Sycamore *(Platanus occidentalis)*

Shrubs
Shadbush *(Amelanchier canadensis)*
Nannyberry *(Viburnum lentago)*
Arrowwood *(Viburnum dentatum)*
Blueberry *(Vaccinium sp.)*
Pink Azalea *(Rhododenron viscosum)*
Silky Dogwood *(Cornus amomum)*
Sweet Pepperbush *(Clethra alnifolia)*
Inkberry *(Ilex glabra)*
Winterberry *(Ilex verticillata)*

Additional Information:

- To combat invasive plants along your shoreline, consider hand pulling or pruning. For more intensive management of invasives, contact the Town to obtain advice and a permit.
- Immediately revegetate any bare or sparse soil areas with a native wildflower seed mix. Consider a mixed species packet of trees or shrubs from **NYS Saratoga Tree Nursery** *www.dec.ny.gov/animals/9391.html*
- Wetland permits are required to conduct any clearing, grading, landscaping, fertilization, or other disturbance within 100 feet of freshwater wetlands, and 300 feet of tidal wetlands.
- For more information on native vegetation and invasive species, visit:
  - **Invasive Plant Council of New York State** *http://www.ipcnys.ene.com/*
  - **Cornell Cooperative Extension of Suffolk County** – Horticulture *http://counties.cce.cornell.edu/suffolk*
  - **Town of Islip** *http://www.townofislip-ny.gov/*
  - **Keep Islip Clean** *http://www.keepislipclean.org/*

After the Storm

A Citizen's Guide to Understanding Stormwater

For more information contact:

Islip Town Environmental Council
Town of Islip
655 Main Street
Islip, NY 11751
(631) 224-5450
commissioner-pd@townofislip-ny.gov

or visit

www.epa.gov/npdes/stormwater
www.epa.gov/nps

United States Environmental Protection Agency

EPA 833-B-03-002

January 2003

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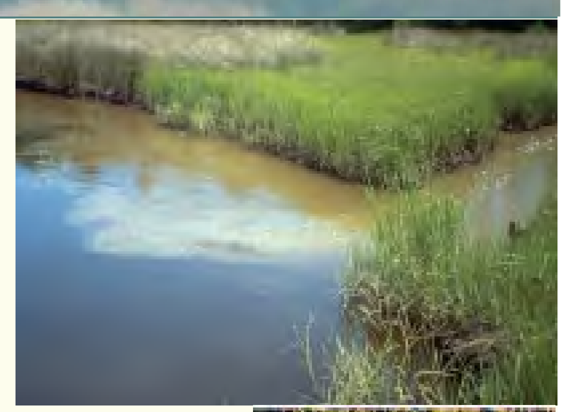
What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

The effects of pollution



Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

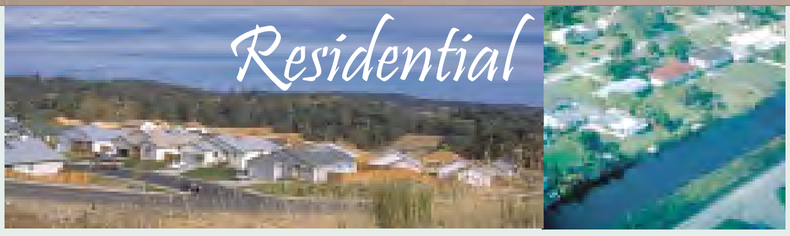
- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.

- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.

- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Residential



Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Pet waste

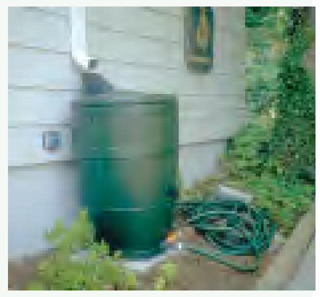
Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.



Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

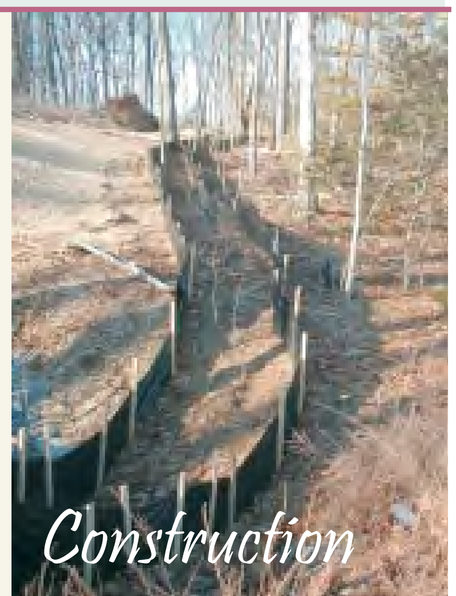
Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction

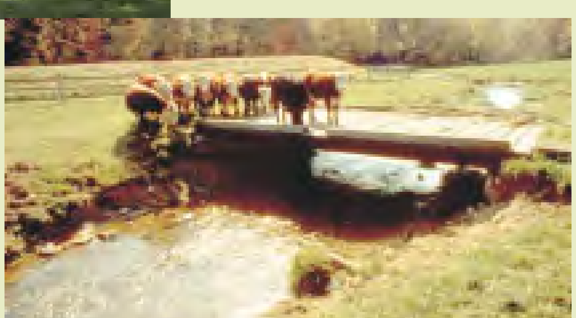
Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.



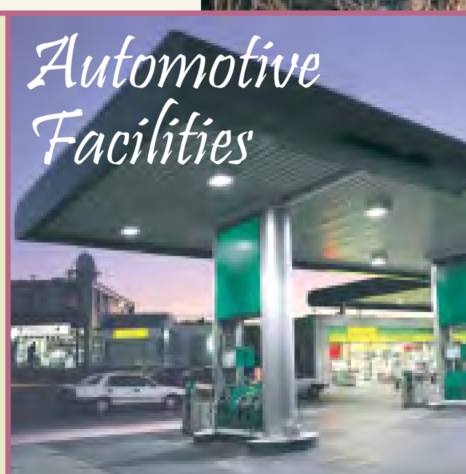
Agriculture

Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.



- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

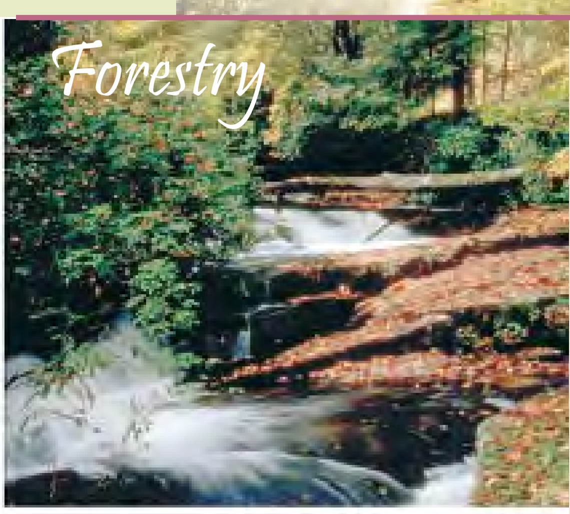
Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Forestry



Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.

Después de la Tormenta

Guía a los Ciudadanos para Entender las Aguas Pluviales

CUANDO LLUEVE SE ESCURRE

Para más información comuníquese con:

O visite
www.epa.gov/npdes/stormwater
www.epa.gov/nps

EPA United States Environmental Protection Agency

EPA 833-B-03-002

Enero de 2003

THE YEAR OF CLEAN WATER

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Qué es la escorrentía de aguas pluviales?

La escorrentía de aguas pluviales ocurre cuando la precipitación de lluvia o el licuado de nieve fluyen sobre la tierra. Las superficies impermeables tales como aceras, calles y vías previenen que las aguas pluviales se escurran en la tierra.

Por qué la escorrentía de aguas pluviales es un problema?

Las aguas pluviales pueden recoger basuras, químicos, suciedad y otros contaminantes y fluir a un sistema de alcantarillado pluvial o directamente a lagos, arroyos, ríos, humedales o aguas costeras. Todo lo que entra a los sistemas de alcantarillado pluviales es descargado sin tratamiento a los cuerpos de agua que usamos para nadar, pescar y como fuentes de agua potable.

Los efectos de la contaminación

La escorrentía de aguas pluviales contaminada puede tener muchos efectos adversos en plantas, peces, animales y personas.

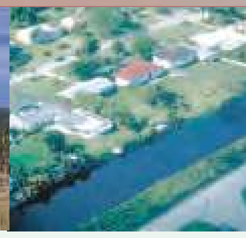
- El sedimento puede opacar las aguas y hace difícil o imposible el crecimiento de plantas acuáticas. El sedimento también puede destruir los hábitats acuáticos.
- El exceso de nutrientes puede causar floración de algas. Cuando las algas mueren, se hunden al fondo y se descomponen en un proceso que remueve oxígeno del agua. Los peces y otros organismos acuáticos no pueden existir en aguas con niveles bajos de oxígeno disuelto.

- Bacterias y otros patógenos pueden llegar a áreas de nado y crear riesgos a la salud, en muchos casos haciendo necesario el cierre de playas.
- Basura como bolsas plásticas, anillos de refrescos de lata, botellas y colillas de cigarrillos que llegan a los cuerpos de agua pueden asfixiar, sofocar o inhabilitar especies acuáticas como patos, peces, tortugas y aves.
- Desechos domésticos peligrosos como insecticidas, plaguicidas, pintura, solventes, aceite usado de motor y otros fluidos de automóviles pueden envenenar la vida acuática. Los animales terrestres y las personas se pueden enfermar o morir por consumir peces y mariscos enfermos o ingerir agua contaminada.

- Las aguas pluviales contaminadas frecuentemente afectan las fuentes de agua potable. Esto a su vez puede afectar la salud humana e incrementar los costos de tratamiento del agua potable.

Soluciones a la Contaminación de Aguas Pluviales

Residencial



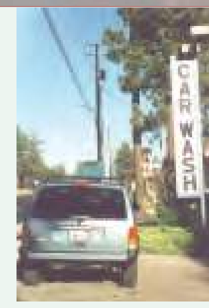
Recicle o deseche adecuadamente los productos domésticos peligrosos que contengan químicos como insecticidas, plaguicidas, pintura, solventes, aceite usado de motor y otros fluidos de automóviles. No los arroje a la tierra o por los desagües pluviales.

Cuidado del Césped

El exceso de fertilizantes y plaguicidas aplicados a céspedes y jardines se escurren y contaminan los arroyos. Adicionalmente, residuos de podas y hojas pueden ser acarreados a los desagües pluviales y contribuir nutrientes y materia orgánica a los arroyos.

- No sobre-riegue su césped. Considere utilizar una manguera para remojar en vez de un aspersor.
- Use plaguicidas y fertilizantes esporádicamente. Cuando su uso sea necesario, utilice estos químicos en las cantidades recomendadas. Use mantillo orgánico o métodos de control de plagas más seguros siempre que sea posible.
- Elabore compost o desmenuce los desechos del jardín. No los abandone en la calle o barra dentro de los desagües pluviales.
- Cubra los cerros de tierra o mantillo utilizados en proyectos de paisajismo.

Cuidado de Automóviles



Lavar su carro o desengrasar piezas de auto en casa puede enviar detergentes y otros contaminantes a los sistemas de alcantarillados pluviales. Arrojar fluidos de automóviles a los desagües pluviales tiene el mismo resultado que arrojar estos materiales directamente a un cuerpo de agua.

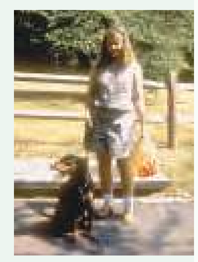
- Utilice lava autos comerciales que tratan o reciclan el agua residual, o lave su auto en el jardín de tal manera que el agua se infiltre en el suelo.
- Repare las fugas y deseche los fluidos usados del automóvil y las baterías en sitios de reciclaje o designados para dejarlos.

Sistemas Sépticos

Sistemas sépticos con fugas o mantenidos inadecuadamente descargan nutrientes y patógenos (bacterias y virus) que pueden ser arrastrados por las aguas pluviales y llevados a los cuerpos de agua cercanos. Los patógenos pueden causar problemas de salud pública e inquietudes ambientales.

- Inspeccione su sistema cada 3 años y bombee el tanque cuando sea necesario (cada 3 a 5 años).
- No arroje productos domésticos peligrosos en lavabos e inodoros.

Desperdicios de Mascotas



Los desperdicios de mascotas pueden ser una fuente importante de bacterias y exceso de nutrientes en las aguas locales.

- Cuando pasee su mascota, recuerde recoger el desperdicio y disponerlo adecuadamente. Eliminar los desperdicios en el inodoro es la manera ideal. Dejar los desperdicios en la tierra aumenta el riesgo a la salud pública al permitir que bacterias nocivas y nutrientes sean lavados a los desagües pluviales y eventualmente a los cuerpos de agua locales.

La educación es esencial para cambiar el comportamiento de las personas. Signos y marcadores cerca de los desagües pluviales advierten a los residentes que los contaminantes que entran al desagüe serán llevados sin tratamiento a los cuerpos de agua locales.

Paisajismo Residencial

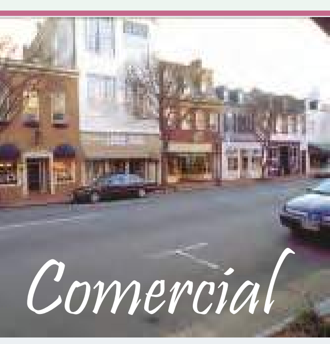
Adoquines Permeables—El concreto y asfalto tradicional no permite que el agua escurra en la tierra. Por el contrario, estas superficies se valen de desagües pluviales para desviar agua no deseada. Los adoquines permeables permiten que la lluvia y el licuado de nieve escurran a través de ellos, disminuyendo la escorrentía de aguas pluviales.

Barriles de Lluvia—Usted puede recolectar el agua de lluvia de los techos en contenedores a prueba de mosquitos. El agua puede luego ser usada en céspedes o jardines.

Jardines de Lluvia y Parcelas de Hierba—Áreas especialmente diseñadas y sembradas con especies nativas pueden proveer lugares naturales para recolectar el agua de lluvia y escurrirla en la tierra. La lluvia que cae en techos y áreas pavimentadas puede ser llevada a estas áreas en vez de los desagües pluviales.

Filtros en Franjas de Hierba—Franjas de filtros son áreas de hierbas o plantas nativas creadas junto a carreteras o arroyos. Estas áreas atrapan los contaminares que las aguas pluviales han recogido en vías y calles.

Comercial



Suciedad, aceites y basura que se acumula en estacionamientos y áreas pavimentadas pueden ser lavados al sistema de drenaje pluvial y eventualmente a los cuerpos de aguas locales.

- Barra la basura de las aceras, vías y estacionamientos, especialmente alrededor de los desagües pluviales.
- Cubra los almacenamientos de grasas y los basureros y manténgalos limpios para evitar fugas.
- Reporte todo derrame de químicos al equipo local de limpieza de desechos peligrosos. Ellos sabrán la mejor manera de prevenir que el derrame afecte el medio ambiente.

Construcción

Los controles de erosión que no son mantenidos pueden llevar a que cantidades excesivas de sedimentos y desechos sean arrastrados al sistema de aguas pluviales. Los vehículos de construcción pueden tener fugas de combustible, aceite y otros fluidos nocivos que pueden ser arrastrados por las aguas pluviales y depositados en los cuerpos de agua locales.

- Desvíe el agua de áreas perturbada o expuestas en el lugar de construcción.
- Instale vallas contra la erosión, áreas de remoción de lodo de vehículos, cobertura vegetal, y otros controles de erosión y sedimentos. Manténgalos adecuadamente, especialmente luego de lluvias.
- Prevenga la erosión del suelo minimizando las áreas perturbadas durante los proyectos de construcción. Esparza semillas y pajote en las áreas despejadas lo antes posible.

Agricultura

La ausencia de vegetación en la banca de los arroyos causa erosión. El sobrepastoreo también contribuye cantidades excesivas de sedimentos a los cuerpos de agua locales. Fertilizantes y plaguicidas en exceso pueden envenenar los animales acuáticos y llevar a floraciones de algas destructivas. El ganado en los arroyos puede contaminar las aguas con bacterias, haciéndolas que no sean seguras para el consumo humano.

- Mantenga el ganado fuera de las bancas de los arroyos y proporciónele una fuente de agua fuera de los cuerpos de agua.

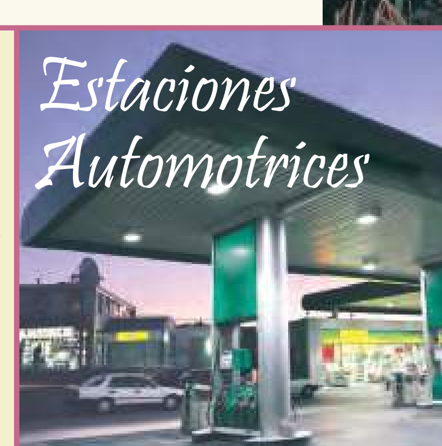
- Almacene y aplique el estiércol lejos de los cuerpos de agua, y de acuerdo con el plan de manejo de nutrientes.
- Siembre las áreas ribereñas a lo largo de las vías acuáticas.
- Rote el pastoreo de animales para prevenir erosión en el campo.
- Aplique fertilizantes y plaguicidas de acuerdo con las instrucciones en las etiquetas. Esto le ahorrara dinero y minimizará la contaminación.

Silvicultura

Operaciones de tala de bosques manejadas inadecuadamente pueden causar erosión y sedimentación.

- Realice planificación pre-cosecha para prevenir erosión y disminuir costos.
- Utilice métodos y equipo de tala que minimicen la perturbación del suelo.
- Planifique y diseñe los caminos de arrastre, parques y caminos de acceso de camiones de tal manera que se minimicen los cruces de arroyos y la perturbación al suelo del bosque.
- Construya los cruces de arroyos de tal manera que minimicen la erosión y los cambios físicos al arroyo.
- Apresure la revegetalización de las areas despejadas.

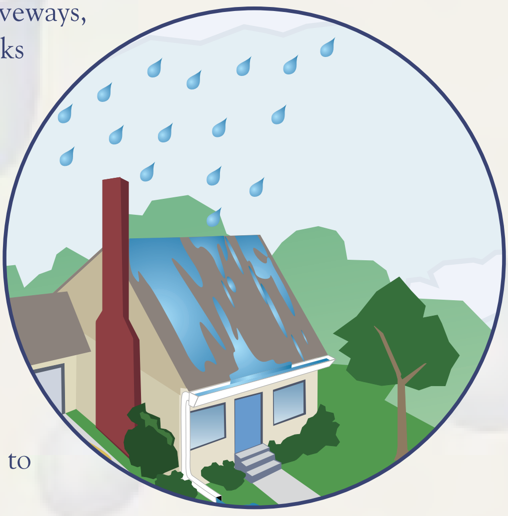
Estaciones Automotrices



Estaciones de combustible descubiertas permiten que los derrames sean lavados a los desagües pluviales. Los automóviles esperando ser reparados pueden tener fugas de combustible, aceite y otros fluidos nocivos que pueden ser arrastrados por las aguas pluviales.

- Limpie los derrames inmediatamente y deseche adecuadamente los materiales de limpieza.
- Provea cobertura sobre las estaciones de combustible y diseñe o modifique las estaciones para contener derrames.
- Mantenga adecuadamente la flota de vehículos para prevenir que combustible, aceite y otras descargas sean arrastradas a los cuerpos de agua locales.
- Instale y mantenga separadores de aceites/agua.

As stormwater flows over driveways, lawns, and sidewalks, it picks up debris, chemicals, dirt, and other pollutants. Stormwater can flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water. Polluted runoff is the nation's greatest threat to clean water.

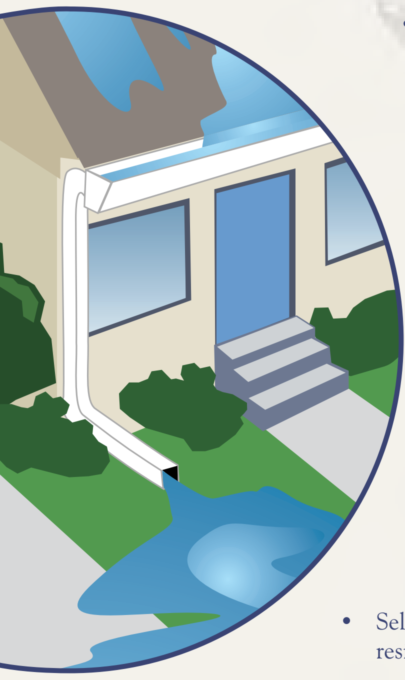


By practicing healthy household habits, homeowners can keep common pollutants like pesticides, pet waste, grass clippings, and automotive fluids off the ground and out of stormwater. Adopt these healthy household habits and help protect lakes, streams, rivers, wetlands, and coastal waters. Remember to share the habits with your neighbors!

Healthy Household Habits for Clean Water

Vehicle and Garage

- Use a commercial car wash or wash your car on a lawn or other unpaved surface to **minimize** the amount of dirty, soapy water flowing into the storm drain and eventually into your local waterbody.



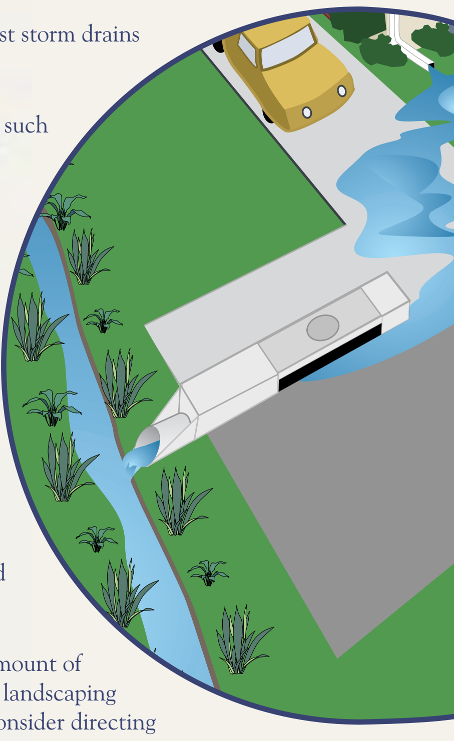
- Check your car, boat, motorcycle, and other machinery and equipment for leaks and spills. Make repairs as soon as possible. Clean up **spilled fluids** with an absorbent material like kitty litter or sand, and don't rinse the spills into a nearby storm drain. Remember to properly dispose of the absorbent material.
- **Recycle** used oil and other automotive fluids at participating service stations. Don't dump these chemicals down the storm drain or dispose of them in your trash.

Lawn and Garden

- Use pesticides and fertilizers **sparingly**. When use is necessary, use these chemicals in the recommended amounts. Avoid application if the forecast calls for rain; otherwise, chemicals will be washed into your local stream.
- Select **native** plants and grasses that are drought- and pest-resistant. Native plants require less water, fertilizer, and pesticides.
- **Sweep up** yard debris, rather than hosing down areas. Compost or recycle yard waste when possible.
- Don't overwater your lawn. Water during the **cool** times of the day, and don't let water run off into the storm drain.
- Cover piles of dirt and mulch being used in landscaping projects to prevent these pollutants from blowing or washing off your yard and into local waterbodies. **Vegetate** bare spots in your yard to prevent soil erosion.

Home Repair and Improvement

- Before beginning an outdoor project, locate the nearest storm drains and **protect** them from debris and other materials.
- **Sweep up** and properly dispose of construction debris such as concrete and mortar.
- Use hazardous substances like paints, solvents, and cleaners in the **smallest amounts possible**, and follow the directions on the label. Clean up spills **immediately**, and dispose of the waste safely. Store substances properly to avoid leaks and spills.
- Purchase and use **nontoxic**, **biodegradable**, **recycled**, and **recyclable** products whenever possible.
- **Clean** paint brushes in a sink, not outdoors. Filter and reuse paint thinner when using oil-based paints. Properly dispose of excess paints through a household hazardous waste collection program, or donate unused paint to local organizations.



- **Reduce** the amount of paved area and increase the amount of vegetated area in your yard. Use native plants in your landscaping to reduce the need for watering during dry periods. Consider directing downspouts away from paved surfaces onto lawns and other measures to increase infiltration and reduce polluted runoff.

Pet Care

- When walking your pet, remember to **pick up** the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Swimming Pool and Spa

- **Drain** your swimming pool only when a test kit does not detect chlorine levels.
- Whenever possible, drain your pool or spa into the **sanitary** sewer system.
- Properly store pool and spa chemicals to **prevent** leaks and spills, preferably in a covered area to avoid exposure to stormwater.

Septic System Use and Maintenance

- Have your septic system **inspected** by a professional at least every 3 years, and have the septic tank **pumped** as necessary (usually every 3 to 5 years).
- Care for the septic system drainfield by **not** driving or parking vehicles on it. Plant only grass over and near the drainfield to avoid damage from roots.
- Flush responsibly. Flushing household chemicals like paint, pesticides, oil, and antifreeze can **destroy** the biological treatment taking place in the system. Other items, such as diapers, paper towels, and cat litter, can **clog** the septic system and potentially damage components.

Storm drains connect to waterbodies!

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United States Environmental Protection Agency
EPA 833-B-03-003
January 2003

Islip Town Environmental Council
Town of Islip
655 Main Street
Islip, NY 11751
commissioner-pd@townofislip-ny.gov

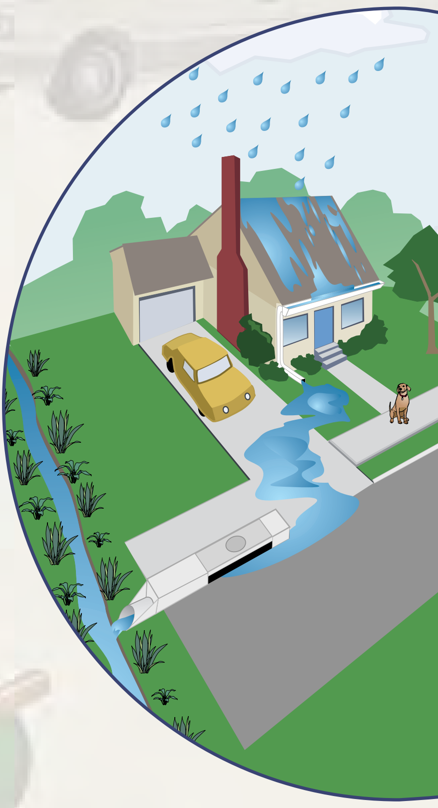
For more information, visit
www.epa.gov/npdes/stormwater
or
www.epa.gov/nps

Remember: Only rain down the drain!

Make your home

The SOLUTION TO STORMWATER POLLUTION!

A homeowner's guide to healthy habits for clean water



United States Environmental Protection Agency

Eco-Friendly Landscaping with Rain Gardens
Reducing your Impervious Footprint

The Problem

Every time it rains, the streams and creeks pick us speed and swell within their banks as pollutant-laden water rushes into them from parking lots, roadways and pipes… carrying pollutants along with it into the coastal waters of Great Cove and ultimately Great South Bay. As more impervious pavement fills the landscape, the resulting problems of water quality and flooding become more pronounced. The Great Cove has reached a threshold where pollutants from paved areas, fertilizers from lawns and impacts from sewage treatment systems and septic tanks have caused problems with water quality. But all hope is not lost! There are still many ways that each of us can reduce our **impervious footprint** and improve the health of our river by minimizing harmful stormwater runoff.

> **Impervious Footprint**:
> The total area of paved or otherwise hardened surfaces (e.g. roofs, driveways) on a property that generate runoff after a rain event or snow melt.

The Solution

We can all be cautious about the types of pollutants that land on our driveways, prevent chemicals from washing into our storm drains, and keep hazardous substances (e.g. paint thinners, pesticides, medicines) out of our sewer pipes. We can also limit the amount of stormwater runoff from our own yards that ends up in the river after a rainstorm. One way to do this is by diverting roof runoff away from paved surfaces, which often funnel water onto driveways and roads, and instead direct your gutters into a shallow planted area (generally 6 inches deep) known as a **rain garden**.

Rain gardens are relatively inexpensive and simple to install. They can be quite diverse and planted with a variety of native perennials, grasses, shrubs and even trees. These landscape features are an easy way to add diversity to your yard while also helping to protect the river from harmful pollutants which can flow in after a rain storm. Sized according to your dwelling's footprint, a strategically located rain garden will collect roof runoff and allow the water to seep into the ground, where it is filtered and cleaned. The roots of the plants in your rain garden also absorb water and some of the contaminants. Additionally, native plants provide food and habitat for a variety of wildlife, including birds, butterflies and beneficial insects.

To construct your own rain garden, follow these 6 steps (summarized from UConn's *"Rain Gardens: A Design Guide for Homeowners in Connecticut"*).

Step 1: Placement of the rain garden

- Locate the garden where it will collect the most runoff, such as downhill from paved surfaces where water would naturally flow.
- Avoid placing them closer than 10 feet from your house's foundation.
- Do not place the rain garden over a septic system, or very close to a water supply well.
- Avoid placing the rain garden in a low spot that always seems wet. To avoid unwanted long term ponding, the rain garden should be in an area that will drain after several hours.

Step 2: Soils

- Determine the suitability of soils at your desired rain garden location by performing a percolation test:
  - Dig a hole about 6 inches deep and fill it with water.
  - If there is still water in the hole after 24 hours, the site is not suitable for a rain garden.

Step 3: Sizing

- To capture the majority of roof runoff, follow these basic steps:
  - Measure the footprint of your house (the area taken up by your house if you were looking down from above).
  - Assess how many gutters you have and determine what portion of the roof area would be contributing water to the gutter downspout that would empty into your desired rain garden location.
  - Divide your roof contributing area by 6. This is the area you need for your rain garden to be able to hold one inch of roof runoff in an area 6 inches deep.
  - From Step 2, if there was some infiltration but it was slow, you can increase the size of your garden to make up for the somewhat poorly draining soils.
  - For silty soils, increase garden size by 50%. For clayey soils, increase size up to 100%.

Step 4: Installation

- Before digging, call the "Call Before You Dig" hotline at 811 to locate any underground utilities.
- Lay out your desired shape for the garden with a string.
- Smaller gardens can be dug by hand with a shovel, or equipment can be rented for larger gardens.
- If the yard is fairly level, just dig out the bowl to a depth of 6 inches, or 8 inches if mulch will be used.
- If the yard is sloped, you may need to use the removed soil to create a small berm (mound) at the downslope side of the garden. This will prevent the soil from washing away after a storm.
- The bottom of the garden should be fairly level to maintain water storage area. A tight string or board and tape measure is helpful. Don't slope the edges too steep to avoid erosion.
- Apply mulch or a ground cover to help stabilize the soils.

Step 5: Planting

Once the shallow depression is dug, you can customize your rain garden by selecting plants according to your desired look and level of maintenance. The best plants for a rain garden are those that can tolerate wet conditions as well as drought. Many native plants are especially good because they are adapted to these variations. Refer to the suggested plant list below to create your own unique rain garden. After the plants are established, they can be maintained as any other plants in your yard.

Shrubs	Perennials	Grasses
Red Chokeberry *(Aronia arbutifolia)*	Joe-Pye Weed *(Eupatorium dubium)*	Switch grass *(Panicum virgatum)*
Highbush Blueberry *(Vaccinium corymbosum)*	Swamp milkweed *(Asclepias incarnata)*	Creeping bentgrass *(Agrostis stolonifera)*
Lowbush blueberry *(Vaccinium angustifolium)*	New York Aster *(Symphyotricum novi-belgii)*	Meadow foxtail *(Alopecurus pratensis)*
Inkberry *(Ilex glabra)*	Hop Sedge *(Carex lupulina)*	Blue joint *(Calamagrostis canadensis)*
Pussy Willow *(Salix discolor)*	Soft Rush *(Juncus effusus)*	Tussock sedge *(Carex stricta)*
Silky Dogwood *(Cornus amomum)*	Rose mallow *(Hibiscus moscheutos)*	Tufted hair grass *(Deschampsia caespitosa)*
Red-osier Dogwood *(Cornus sericea)*	Marsh Marigold *(Caltha palustris)*	
Gray dogwood *(Cornus racemosum)*	Tickseed sunflower *(Bidens aristosa)*	
Elderberry *(Sambucus canadensis)*	Lanceleaf coreopsis *(Coreopsis lanceolata)*	

Shrubs (continued)

Winterberry *(Ilex verticillata)*
Spicebush *(Lindera benzoin)*
Buttonbush *(Cephalanthus occidentalis)*
Sweet Pepperbush *(Clethra alnifolia)*
Swamp azalea *(Rhododendron viscosum)*
Pinxterbloom azalea *(R. periclymenoides)*
Witherod *(Viburnum cassinoides)*
Arrowwood *(Viburnum dentatum)*
Nannyberry *(Viburnum lentago)*
Black haw *(Viburnum prunifolium)*
American cranberry *(Viburnum trilobum)*

Perennials (continued)

Iris *(Iris versicolor)*
Cardinal Flower *(Lobelia cardinalis)*
Monkey Flower *(Mimulus ringens)*
Scarlet Bee-balm *(Monarda didyma)*
False goat's beard *(Astilbe spp.)*
Spiderwort *(Tradescantia virginiana)*
Spiked gay feather *(Liatris spicata)*
Sensitive fern *(Onoclea sensibilis)*
Cinnamon fern *(Osmunda cinnamomea)*
Royal fern *(Onoclea regalis)*
Marsh fern *(Thelypteris palustris)*

Trees

River birch *(Betula nigra)*
Red maple *(Acer rubrum)*
Sweetgum *(Liquidambar styracifolia)*
Swamp white oak *(Quercus bicolor)*
Pin oak *(Quercus palustris)*
Larch *(Larix laricina)*
Cottonwood *(Populus deltoides)*
Shadblow *(Amelanchier spp.)*
Green ash *(Fraxinus pennsylvanica)*

Step 6: Maintenance

- Water newly installed plants until established, and weed as necessary.
- In the years following installation, remove dead plant material, prune shrubs and replace mulch as desired.

For further details on how to design your own rain garden, visit http://www.sustainability.uconn.edu/ to download the full design guide. Not enough room? Visit http://www.dec.ny.gov/public/44330.html to learn how to install a Mini Rain Garden in a Planter.

A low-maintenance rain garden in winter. For winter interest, use plants with red berries (e.g. winterberry, red chokeberry) and inkberry, a native evergreen.

Your gutters can also be retrofitted to attach to a **rain barrel**, which collects and stores rainwater for use in your landscape. Locally-made rain barrels can be purchased from companies, such as the following:
Aaron's Rain Barrels: http://www.ne-design.net/
The New England Rain Barrel Company: http://www.nerainbarrel.com/

FOUR-SEASON YARD WORKER TIP SHEET
FOR RESPONSIBLE LANDSCAPE CARE
"To improve properties and waterways"

Visit www.townofislip-ny.gov for links to more information, including the Town recycling and free compost program.

Spring Maintenance

✓ Sweep up leftover sand from sidewalks and driveway, store in buckets for next winter. Don't dump swept-up sand (contains salt and other pollutants) into gardens, wetlands, or woods.
✓ Locate an area on the property for a long-term compost pile. Composting will avoid need for expensive, potentially harmful chemical fertilizers; and provide rich organic material to benefit plants naturally.
✗ Don't blow/rake leaves and other organic matter into streams, ponds, or wetlands; they harm plants and beneficial wildlife, make ponds shallower, encourage excess algae, speed up the need for dredging and aerators, and may incur fines or costly mitigation.
✓ Recycle fall leaves by using them as a base for a new compost pile, or chop up leaves (with a lawn mower or shredder) for mulch around shrubs and on planting beds.
✓ Mulch 2" deep around trees, shrubs, planting areas to reduce moisture loss, cool plants, and reduce weeds. Keep mulch off tree/shrub bark to avoid killing the plant and off plant crowns to avoid root rot. Avoid fresh wood chips that rob plants of nitrogen. Consider chopped leaves, pine needles, shredded bark, Sweet Peet.
✓ Spread thin layer of compost on lawn and planting areas in late spring to provide organic nutrients for healthy growth. (*Free compost available to Town residents at MacArthur Composting Facility).*
✗ Avoid 2-in-1 mix of pesticides and fertilizers.
✓ Use non-toxic alternatives to chemical pesticides. Good alternatives are horticultural oils, Neem oil, and soap solutions.
✓ Reduce or eliminate lawn areas and extra care and water they require. Plant groundcovers, or native grasses (e.g., little bluestem) with perennial wildflowers for a meadow look that will endure.
✓ At the beginning of April, note and identify the first nonevergreen plants to leaf out (likely invasive Japanese barberry, winged euonymus, Japanese honeysuckle, multiflora rose, garlic mustard). Research right method of control for each, then dig out or control. See Winter.
✓ Install a wide buffer of native plantings 3' tall to block geese's view of water to deter their presence, droppings, and polluting runoff.
✓ Check pruning timing for shrubs and trees: right after flowering in spring or in fall, according to plant. Even native plants need some pruning for size and shape.

Summer Care

✓ Save water. Water before 9 AM to minimize evaporation and disease. Lawns need maximum 1" water per week from rain or irrigation.
✗ Do not overwater or water lawn more than once per week. Frequent watering discourages deep root growth and weakens grass. In drought, do not water; lawns can green up after browning.
✓ Established trees/shrubs do not require water, except in drought. Reduced growth keeps pruning down and prolongs the life of the plant that will outgrow its space.
✓ Use a rain gauge or place shallow can under sprinkler to measure water levels. Install an inexpensive rain sensor on an automatic sprinkler system to effectively prevent sprinklers from coming on during or after rain.
✓ Keep mower blades sharp to reduce moisture loss and prevent disease spread. Mow lawn 2.5-3" minimum. Use a mulching mower to let grass clippings or chopped leaves fertilize the lawn.
✓ Mow a curved (not straight, downhill) path to stream or pond to slow runoff and pollution, to allow for more absorption, and to deter geese if other vegetation is high.
✓ Continue to weed and re-mulch where necessary, but remove mulch every three years if 2" is added annually.

Fall Leaves and Fertilization

✗ Don't blow or dump leaves into waterways, wetlands, roadsides, or open lands. Compost them. Chop and compost leaves for spring use or bring to Town compost facility rather than trash this valuable and nutritious resource.
✓ Fertilize the lawn with a single dose of slow-release, organic fertilizer in early fall for a healthy spring lawn.
✓ In late fall, to avoid disease, remove spent annuals and dead leaves/flowers from perennials; add to compost pile, unless diseased, in which case, put in garbage.

Winter De-icing and Planning

✗ Avoid rock salt to de-ice sidewalks and driveways. Rock salt can harm aquatic and plant life and eat into pavement, concrete foundations. Use Calcium Chloride or Calcium Magnesium Acetate (CMA) products to melt ice, or use plain sand if only traction is needed.
✓ Sweep up sand from sidewalks and driveway in between storms, re-use for the next storm.
✓ Plan to remove invasive plants; replace them in the spring with native trees, shrubs, plants, or groundcovers that require less water and care, and attract wildlife.
✓ Plan a rain garden by directing downspouts and runoff into an area designed with proper drainage and planted with native, low maintenance bushes, shrubs, and perennial flowers that can live through flood and drought.

with funding by the NYS Department of State through the Environmental Protection Fund.

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with funding by the NYS Department of State through the Environmental Protection Fund.

HOJA DE CUIDADOS RESPONSABLES PARA SU JARDIN
"Para mejorar las propiedades y el agua"

Visite www.townofislip-ny.gov para más información, incluyendo el reciclaje de la ciudad y programa de abono gratis.

Mantenimiento en Primavera

- Recoja los restos de arena de aceras y calzadas, almacene en baldes para el próximo invierno. No volcararena (contiene sal y otros contaminantes) en los jardines, pantanos o bosques.
- Localizar un espacio en su propiedad para hacer un compuesto de pila. El compostaje le ahorrara dinero, y evitara la necesidad de costosos, potencialmente dañinos fertilizantes químicos, y ofrece material orgánico para beneficiar a las plantas de manera natural.
- NO sople o rastrille las hojas y otras materias orgánicas en arroyos, estanques, o pantanos; ellos pueden dañar las plantas y la fauna beneficiosa, hacer los estanques poco profundos, enriquecer y fomentar algas, y puede incurrir en multas o costosos juicios.
- Recicle las hojas, utilizándolas en un compuesto, muela las hojas; y úselas alrededor de arbustos y plantas.
- Utilice 2" de profundidad alrededor de árboles y plantas, para reducir la pérdida de humedad, y reducir las malezas. Mantenga fuera de los troncos para evitar pudrir la raíz. Evite las virutas de madera fresca que pueden robar a las plantas de nitrógeno. Considere hojas picadas, agujas de pino, corteza desmenuzada.
- Esparza una fina capa de compuesto sobre césped y plantas a finales de primavera para proporcionar nutrientes orgánicos para un crecimiento saludable. (abono gratuito para los residentes de la ciudad).
- Evite la mezcla 2-en-1 de pesticidas y fertilizantes.
- Utilice alternativas no tóxicas en lugar de los insecticidas químicos. Buenas alternativas son los aceites hortícolas, Neem y soluciones de jabón.
- Reduzca o elimine las zonas de césped por el cuidado especial y el agua que necesitan. Plantar rastreadoras, o pastos nativos (por ejemplo, bluestem) con flores silvestres para un prado que perdurará.
- A principios de abril, tome nota e identifique, las 1as plantas de hoja (probable barberry invasoras japonesas, euonymus, madreselvas, rosa multifloras). Investigue un método correcto para entonces extraer o controlar. Véase invierno.
- Instale una barrera de plantas nativas de 3' de altura para bloquear la vista de los gansos del agua para disuadir su presencia, excrementos y contaminantes.
- Comprobar la época para la poda de arbustos y árboles: justo después de la floración en primavera o en otoño, de acuerdo con la planta.

Mantenimiento en Verano

- Conserve agua. Riegue antes de las 9 AM para reducer al mínimo la evaporación y enfermedades. El césped necesita un máximo de 1" de agua por semana, ya sea lluvia o riego. No riegue de más o más de una vez por semana. El riego frecuente debilita la raíz y el crecimiento. En sequía, no riegue; el césped se recuperará después de haberse secado.
- Utilice un pluviómetro o un contenedor poco profundo cerca del rociador para medir los niveles de agua. Instale un sensor de lluvia de bajo costo, para prevenir regar automáticamente después de la lluvia.
- Mantenga las cuchillas afiladas de su cortadora de pasto para reducir la pérdida de humedad y prevenir enfermedades. Cortar el césped 2.5-3" mínimo. Utilice un cortacésped especial para dejar que lo recién cortado fertilice el césped.
- Corte el césped en curva (no recto, bajo) para crear un camino a un arroyo o estanque para frenar la erosión y la contaminación y para permitir un mayor absorción.
- Continúe desmalezando y cortando cuando sea necesario.

Las hojas de Otoño y fertilización

- No sople o vierta las hojas en aguas, pantanos, bordes de caminos, o espacios abiertos. Muela las hojas y úselas en el compuesto para la primavera, o déjelas descomponer en los bosques de forma natural, para aprovechar este valioso recurso; en lugar de ponerlas en bolsas o en la basura.
- Fertilizar el césped con una sola dosis de liberación lenta, de un fertilizante orgánico a principios del otoño para un césped sano en primavera.
- A finales de otoño, para evitar enfermedades, eliminar plantas anuales y hojas y flores muertas; añadir al montón del compuesto, menos las enfermas, en cuyo caso, poner en la basura.

Invierno deshielo y Planificación

- Evitar sal de roca para aceras y calzadas. La sal de roca puede dañar las plantas y vida acuática y destruir el pavimento y las bases de concreto. Utilice de cloruro de calcio o acetato de calcio magnesio (CMA) es recomendado para derretir el hielo, o utilice arena si necesita tracción.
- Recoger arena de aceras y calzada entre tormentas, reutilice las para la próxima tormenta.
- Planee eliminar especies invasoras; sustituirlas en primavera con árboles nativos o plantas que requieren menos agua y atención, y atraen la fauna silvestre.
- Planee un jardín de lluvia, dirigiendo la erosión en un espacio diseñado con buen drenaje y con plantas nativas y de bajo mantenimiento, y flores que pueden vivir a través de las inundaciones y la sequía.

with funding by the NYS Department of State through the Environmental Protection Fund.

APPENDIX F

STORMWATER IMPROVEMENT PROJECTS
&
DETAILS

APPENDIX F-1

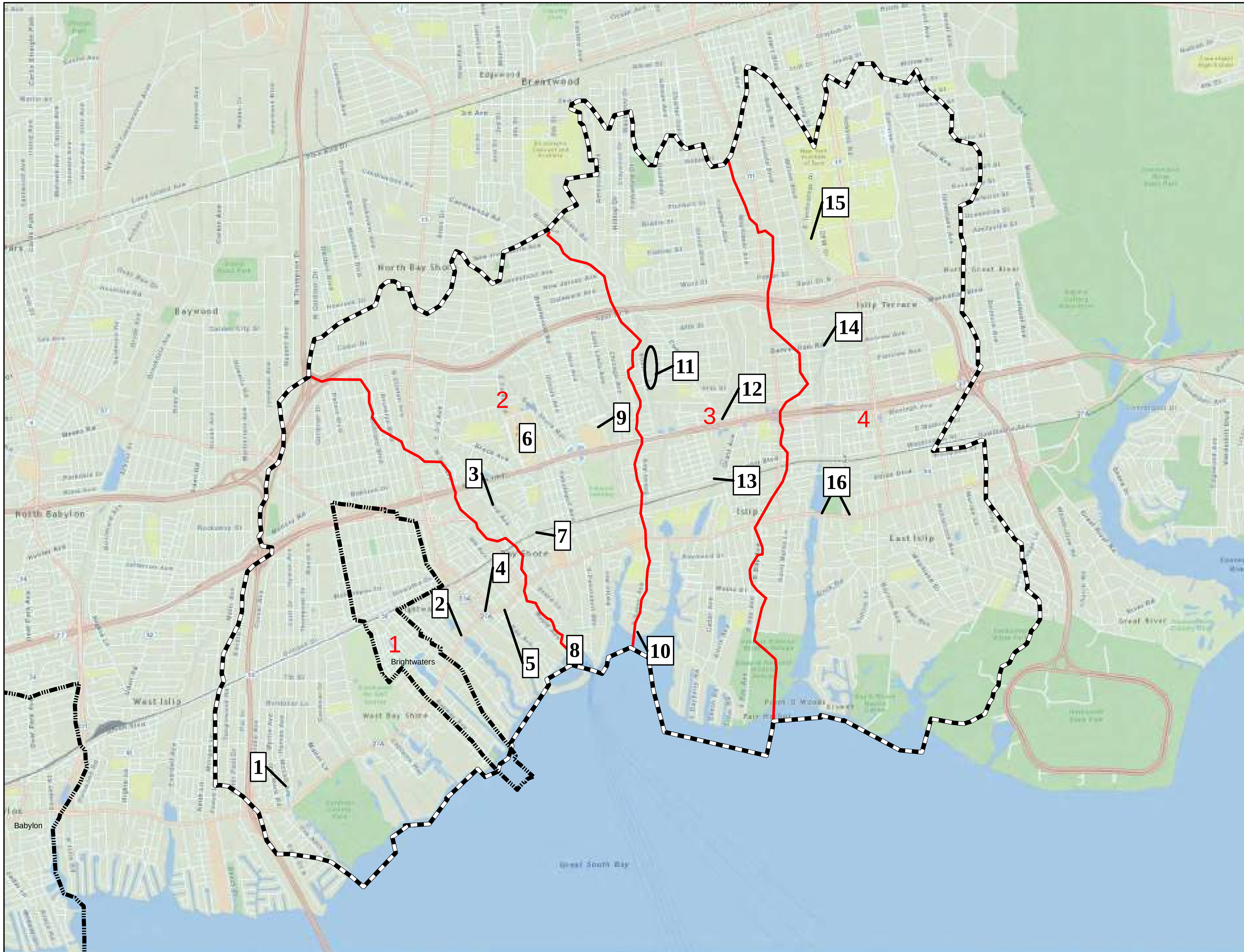
CONCEPT PLANS

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

FIGURE 1-1
LOCATION MAP

SOURCE: Town of Islip GIS; ESRI World Street Map
SOURCE DATE: February 2010



Legend

- Great Cove Overall Watershed Boundary
- Sub-Areas
- Village Boundary
- 14 Drainage Improvement Locations

1 inch = 4,000 feet

N

Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting

G:\projects\09186\ENVIRONMENTAL\GIS\Figures\Figure 1-1 Location_Plain.mxd

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 1
TRUES CREEK @ ARCHIE

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

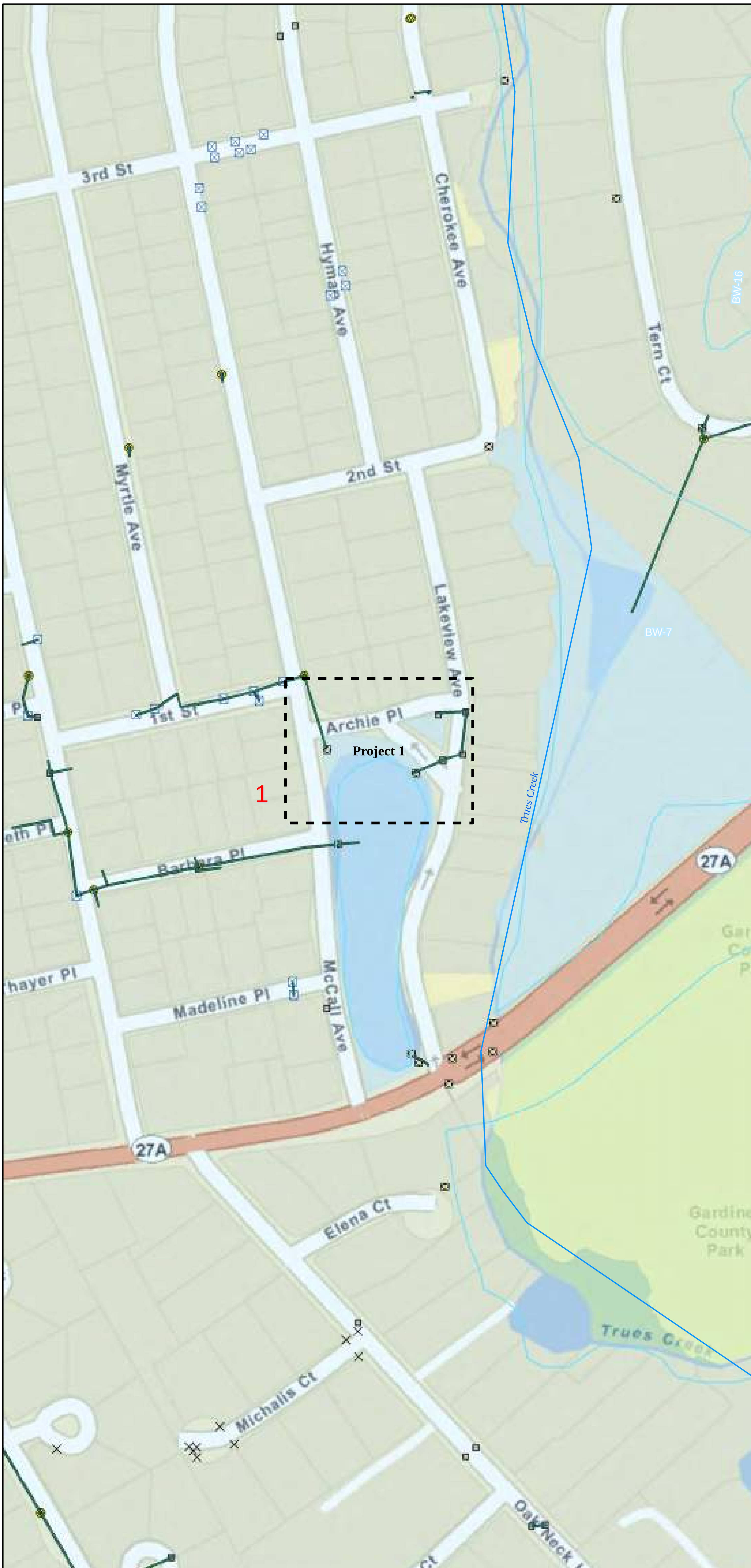
Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements

Scale: 1" = 30'

NORTH

Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting



Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 1 TRUES CREEK @ ARCHIE

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Stream
- NYSDEC Freshwater Wetlands
- Proposed Drainage Improvement Areas
- Recharge Basins

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping
- Outfall

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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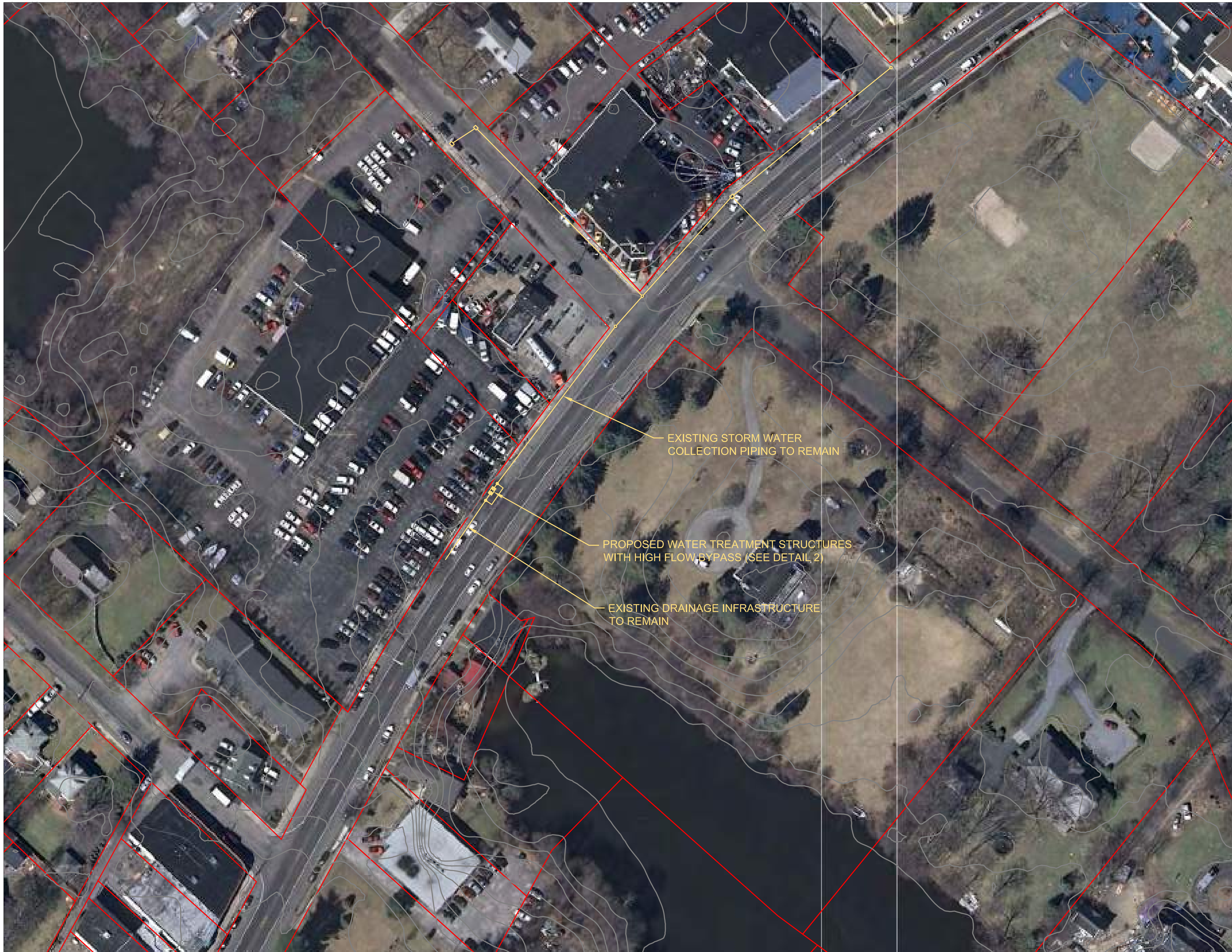
Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED
MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 2 LAWRENCE CREEK

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011



Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements

Scale: 1" = 100'

NORTH

Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 2 LAWRENCE CREEK

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Stream
- NYSDEC Freshwater Wetlands
- Proposed Drainage Improvement Areas
- Recharge Basins

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping
- Outfall

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 3 PENATAQUIT TOWN HOUSING

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements

Scale: 1" = 40'

NORTH

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Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 3 PENATAQUIT TOWN HOUSING

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Proposed Drainage Improvement Areas
- Detail Area
- Stream
- Recharge Basins
- NYSDEC Freshwater Wetlands
- Outfall

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 4 WATCHOGUE @ MECHANICSVILLE

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements
- Proposed Low Profile Leaching System

Scale: 1" = 40'

NORTH

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New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 4 WATCHOGUE @ MECHANICSVILLE

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Proposed Drainage Improvement Areas
- Detail Area
- Stream
- Recharge Basins
- NYSDEC Freshwater Wetlands
- Outfall

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 5 WATCHOGUE @ GIBSON

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

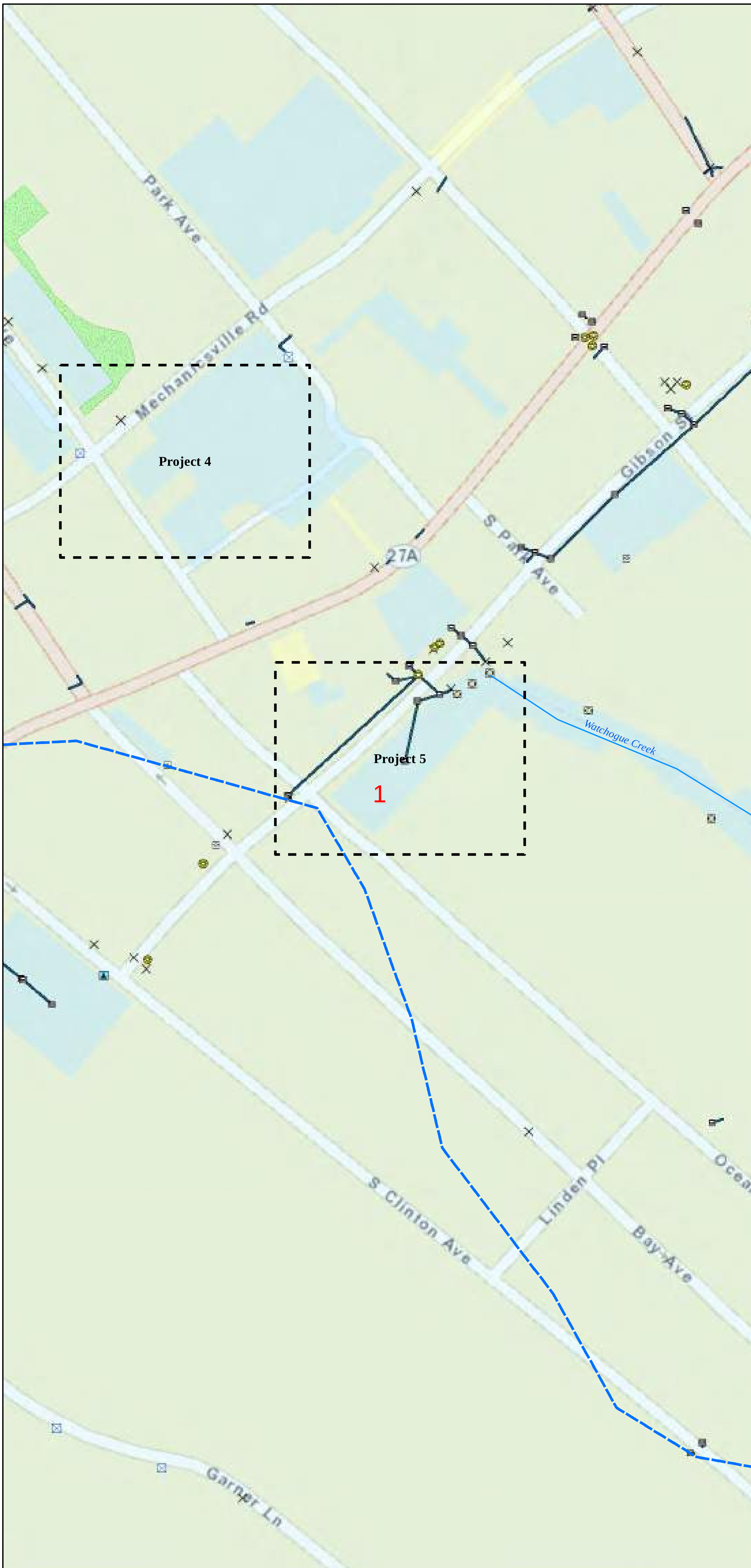
Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements
- Proposed Pervious Pavement

Scale: 1" = 40'

NORTH

Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting



Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 5 WATCHOGUE @ GIBSON

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Proposed Drainage Improvement Areas
- Detail Area
- Stream
- Recharge Basins
- NYSDEC Freshwater Wetlands
- Outfall

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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Environmental Planning & Consulting

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New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 6 MALL

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Existing Drainage Infrastructure
- Proposed Drainage Improvements
- Proposed Bioretention Area (See Detail 1)

Scale: 1" = 300'

NORTH

NP&V

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and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 6 SOUTH SHORE MALL

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Proposed Drainage Improvement Areas
- Detail Area
- Stream
- Recharge Basins
- NYSDEC Freshwater Wetlands
- Outfall

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 300 feet

N

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New York Department of State

GREAT COVE WATERSHED
MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 7 PENATAQUIT 2ND AVE. HIGHWAY YARD

Source: NYSGIS Orthoimagery Program, 2007;
Town of Islip GIS; Suffolk County LIDAR, 2007;
NP&V Field Surveys, 2011

Legend

Suffolk County Tax Parcels

Topographic Contour

Proposed Drainage Improvements

Scale: 1" = 80'

NORTH

S:\imagefiles\NPVCOLOR.BMP

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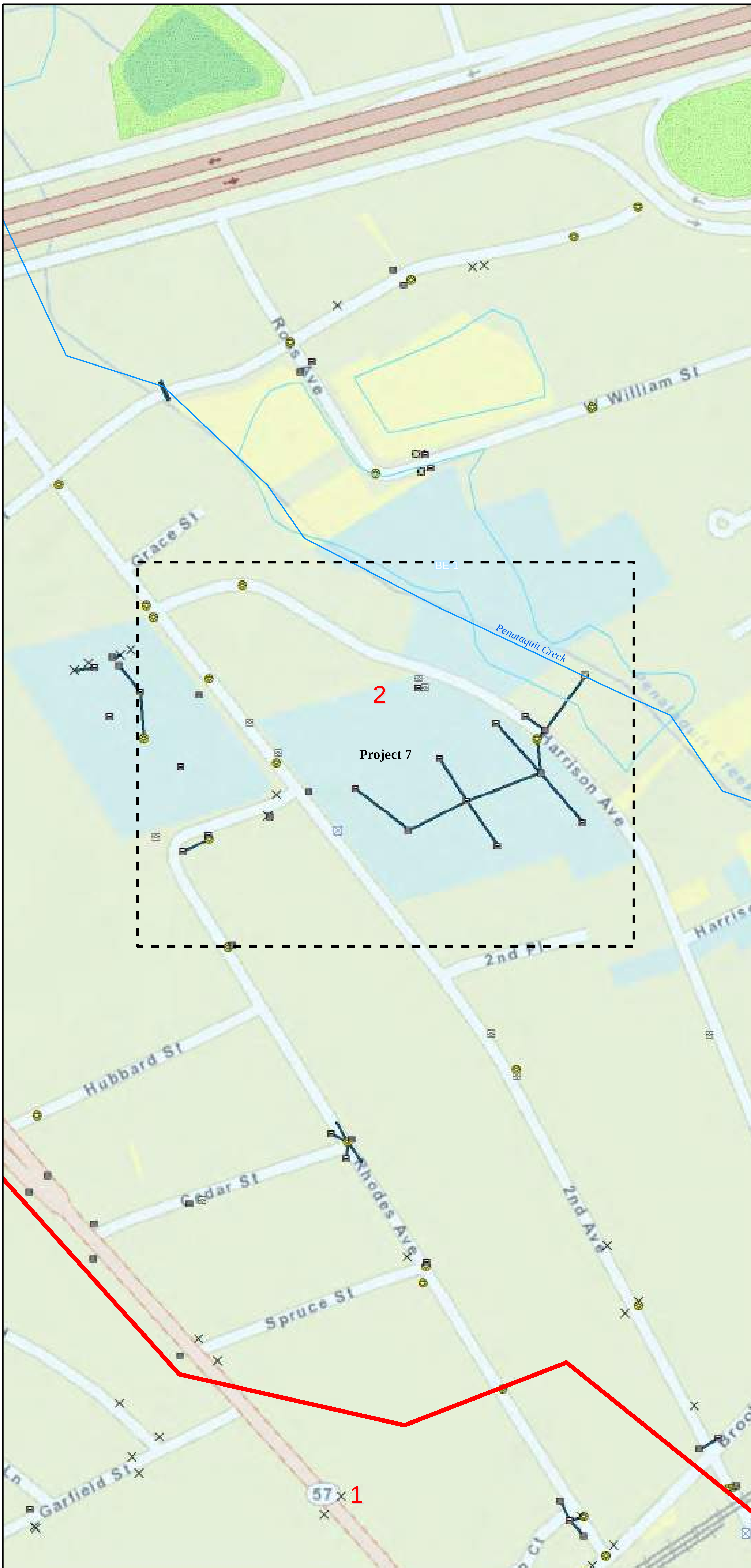

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 7 PENATAQUIT CREEK 2nd Avenue Garage

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Proposed Drainage Improvement Areas
- Detail Area
- Stream
- Recharge Basins
- NYSDEC Freshwater Wetlands
- Outfall

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 8 MAPLE AVE. PARKING

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements
- Proposed Low Profile Leaching System

Scale: 1" = 80'

NORTH

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Environmental Planning & Consulting

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and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 8 MAPLE AVE. PARKING

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Proposed Drainage Improvement Areas
- Detail Area
- Stream
- Recharge Basins
- NYSDEC Freshwater Wetlands
- Outfall

Drainage Infrastructure
- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping

Publicly Owned Land
- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 9 AWIXA @ OAKWOOD

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements

Scale: 1" = 50'

NORTH

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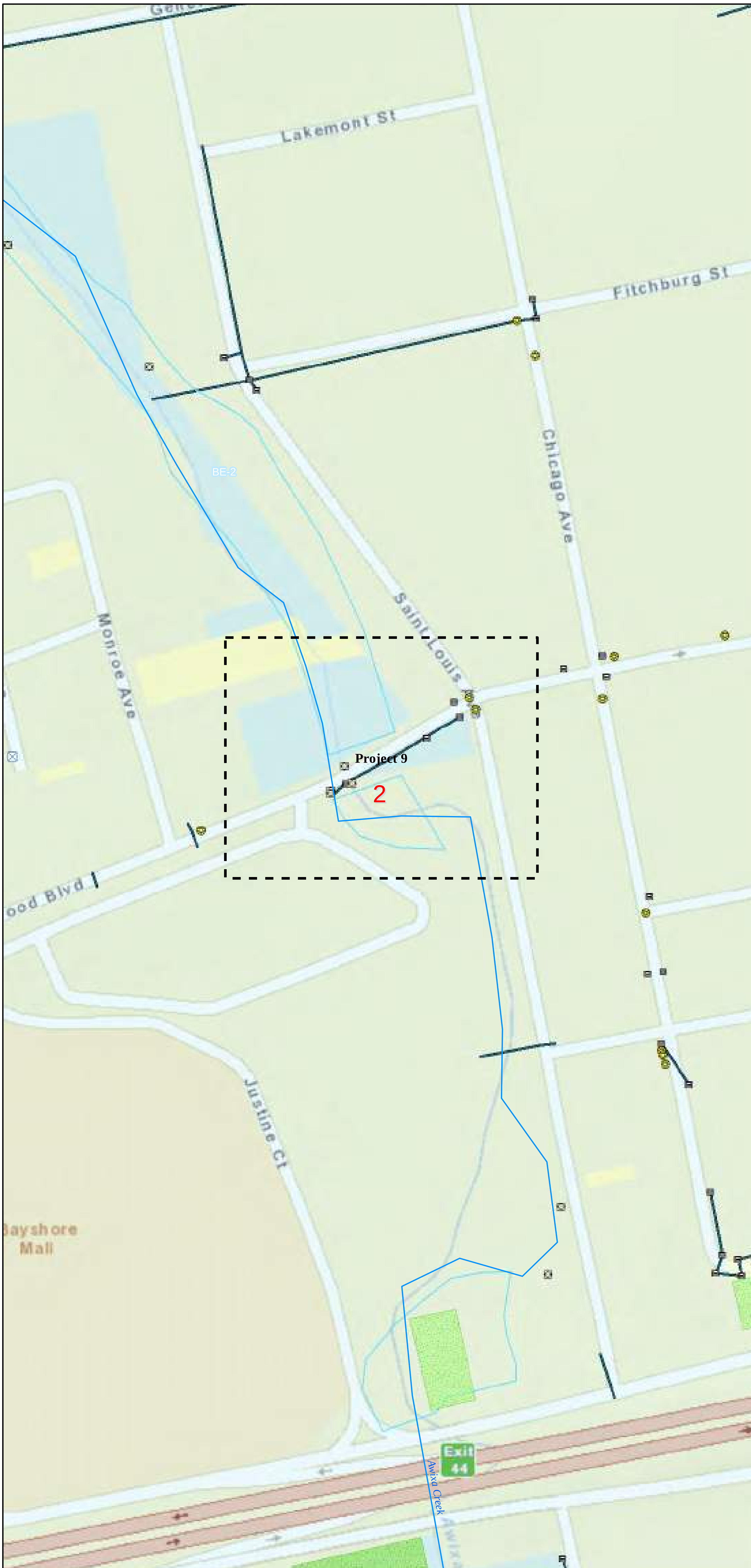

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 9 AWIXA @ OAKWOOD

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Proposed Drainage Improvement Areas
- Detail Area
- Stream
- Recharge Basins
- NYSDEC Freshwater Wetlands
- Outfall

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 10 SAXON CUL-DE-SAC

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements

Scale: 1" = 30'

NORTH

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Environmental Planning & Consulting

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GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 10 SAXON CUL-DE-SAC

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Stream
- NYSDEC Freshwater Wetlands
- Proposed Drainage Improvement Areas
- Recharge Basins

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping
- Outfall

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 11 OROWOC ROAD ENDS - OVERALL

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements
- Leaching Catch Basin
- Bio-Retention Area

Scale: 1" = 200'

NORTH

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Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 11 OROWOC ROAD ENDS

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Proposed Drainage Improvement Areas
- Detail Area
- Stream
- Recharge Basins
- NYSDEC Freshwater Wetlands
- Outfall

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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Environmental Planning & Consulting

Town of Islip
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New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 11 OROWOC ROAD ENDS - OVERALL

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements
- Leaching Catch Basin
- Bio-Retention Area

NORTH

Scale: 1" = 200'

Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED
MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 12
OROWOC @ COMMACK RD.

Source: NYSGIS Orthoimagery Program, 2007;
Town of Islip GIS; Suffolk County LIDAR, 2007;
NP&V Field Surveys, 2011

Legend

Suffolk County Tax Parcels

Topographic Contour

Proposed Drainage Improvements

Scale: 1" = 50'

NORTH

NP&V
Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 12 OROWOC @ COMMACK RD.

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Proposed Drainage Improvement Areas
- Detail Area
- Stream
- Recharge Basins
- NYSDEC Freshwater Wetlands
- Outfall

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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Town of Islip
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New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 13 OROWOC @ MOFFIT

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Stream
- NYSDEC Freshwater Wetlands
- Proposed Drainage Improvement Areas
- Recharge Basins

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping
- Outfall

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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Environmental Planning & Consulting

Town of Islip
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New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 13 OROWOC @ MOFFIT

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements
- Proposed Low Profile Leaching System

Scale: 1" = 60'

NORTH

Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting

Town of Islip
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New York Department of State

GREAT COVE WATERSHED
MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 14 CHAMPLIN @ FISHER PARK

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements
- Proposed Low Profile Leaching System

Scale: 1" = 80'

NORTH

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Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 14 CHAMPLIN @ FISHER PARK

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Stream
- NYSDEC Freshwater Wetlands
- Proposed Drainage Improvement Areas
- Recharge Basins

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping
- Outfall

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 200 feet

N

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GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 15 CHAMPLIN @ DPW YARD

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements

Scale: 1" = 150'

NORTH

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Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 15 CHAMPLIN @ DPW YARD

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Stream
- NYSDEC Freshwater Wetlands
- Proposed Drainage Improvement Areas
- Recharge Basins

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping
- Outfall

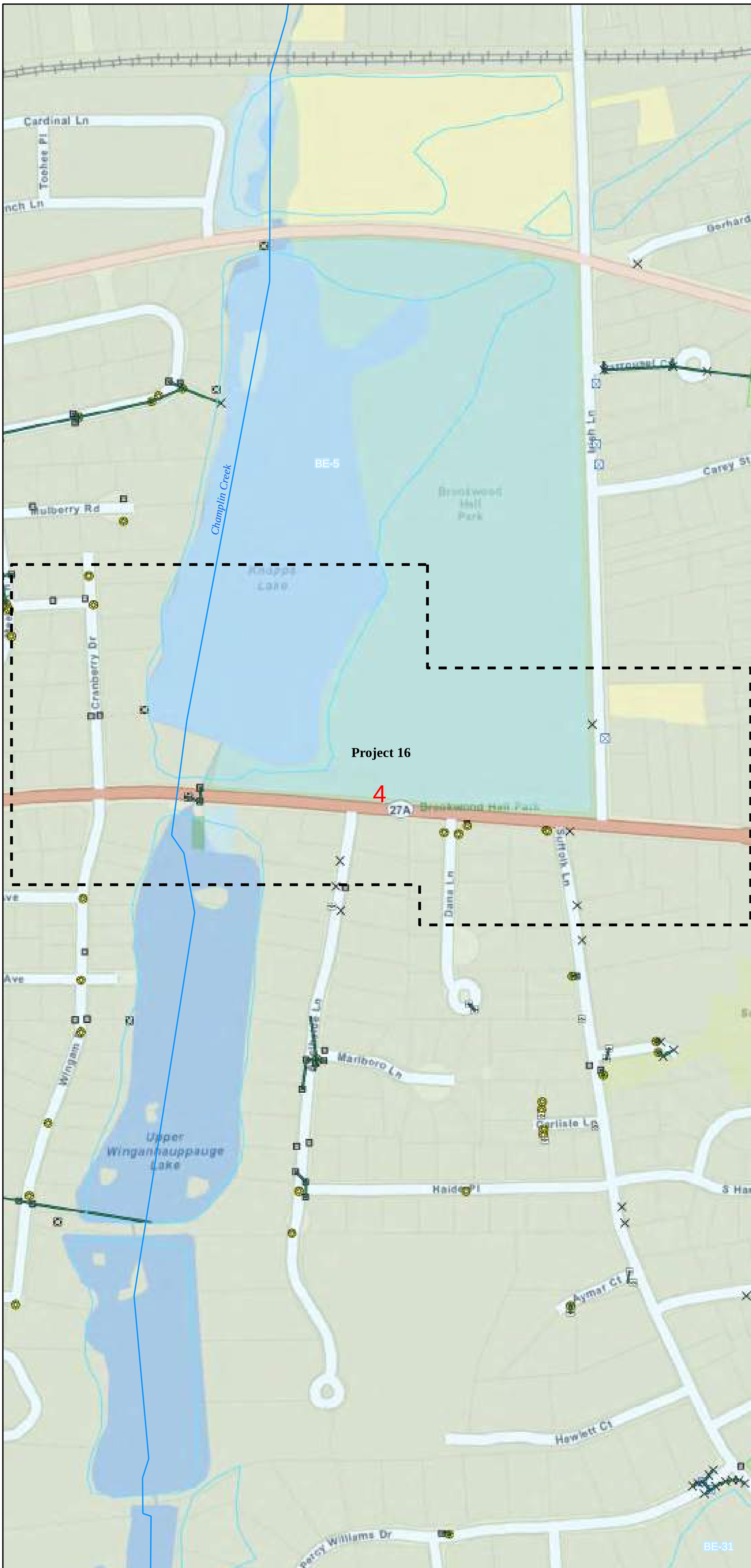
Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 400 feet

N

Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting



Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE INFRASTRUCTURE PROJECT 16 CHAMPLIN @ BROOKWOOD HALL PARK

SOURCE: NYSGIS Clearinghouse; Town of Islip; USGS
SOURCE DATE: December 2010

Legend

- Sub-Areas
- Individual Watershed Boundaries
- Stream
- NYSDEC Freshwater Wetlands
- Proposed Drainage Improvement Areas
- Recharge Basins

Drainage Infrastructure

- Catch Basin
- Leaching Catch Basin
- Leaching Pool
- Manhole
- NA
- Other
- Drainage Piping
- Outfall

Publicly Owned Land

- County Owned
- Village Owned
- Town of Islip Owned
- State Owned
- Federally Owned

1 inch = 300 feet

N

Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 16 CHAMPLIN @ BROOKWOOD HALL PARK EAST

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements

Scale: 1" = 80'

NORTH

NP&V
Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 16 CHAMPLIN @ BROOKWOOD HALL PARK EAST

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011

Legend

Suffolk County Tax Parcels

Topographic Contour

Proposed Drainage Improvements

Scale: 1" = 80'

NORTH

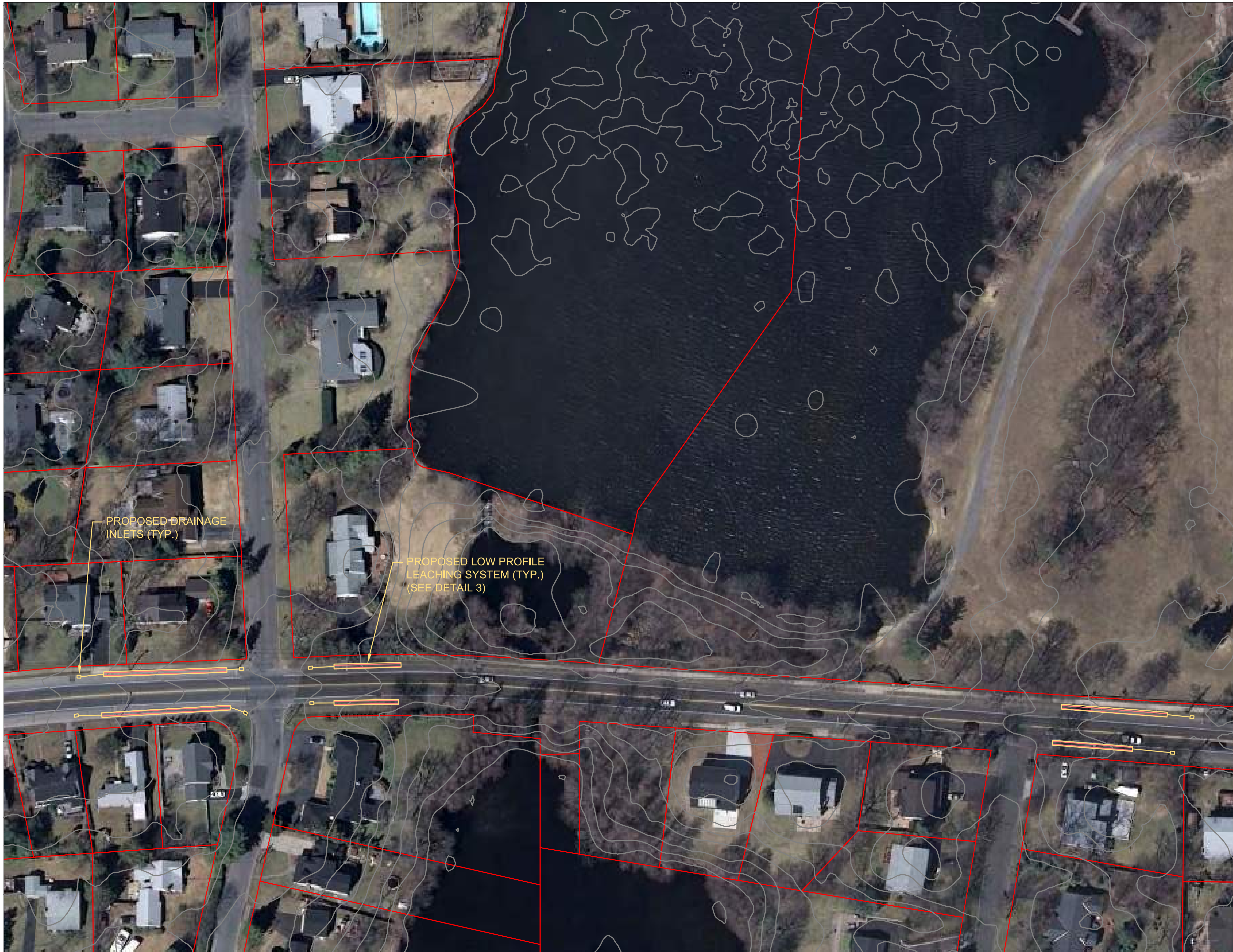
Nelson, Pope & Voorhis, LLC
Environmental Planning & Consulting

Town of Islip
and
New York Department of State

GREAT COVE WATERSHED MANAGEMENT PLAN

DRAINAGE IMPROVEMENT PROJECT 16 CHAMPLIN @ BROOKWOOD HALL PARK WEST

Source: NYSGIS Orthoimagery Program, 2007; Town of Islip GIS; Suffolk County LIDAR, 2007; NP&V Field Surveys, 2011



Legend

- Suffolk County Tax Parcels
- Topographic Contour
- Proposed Drainage Improvements
- Proposed Low Profile Leaching System

Scale: 1" = 100'

NORTH

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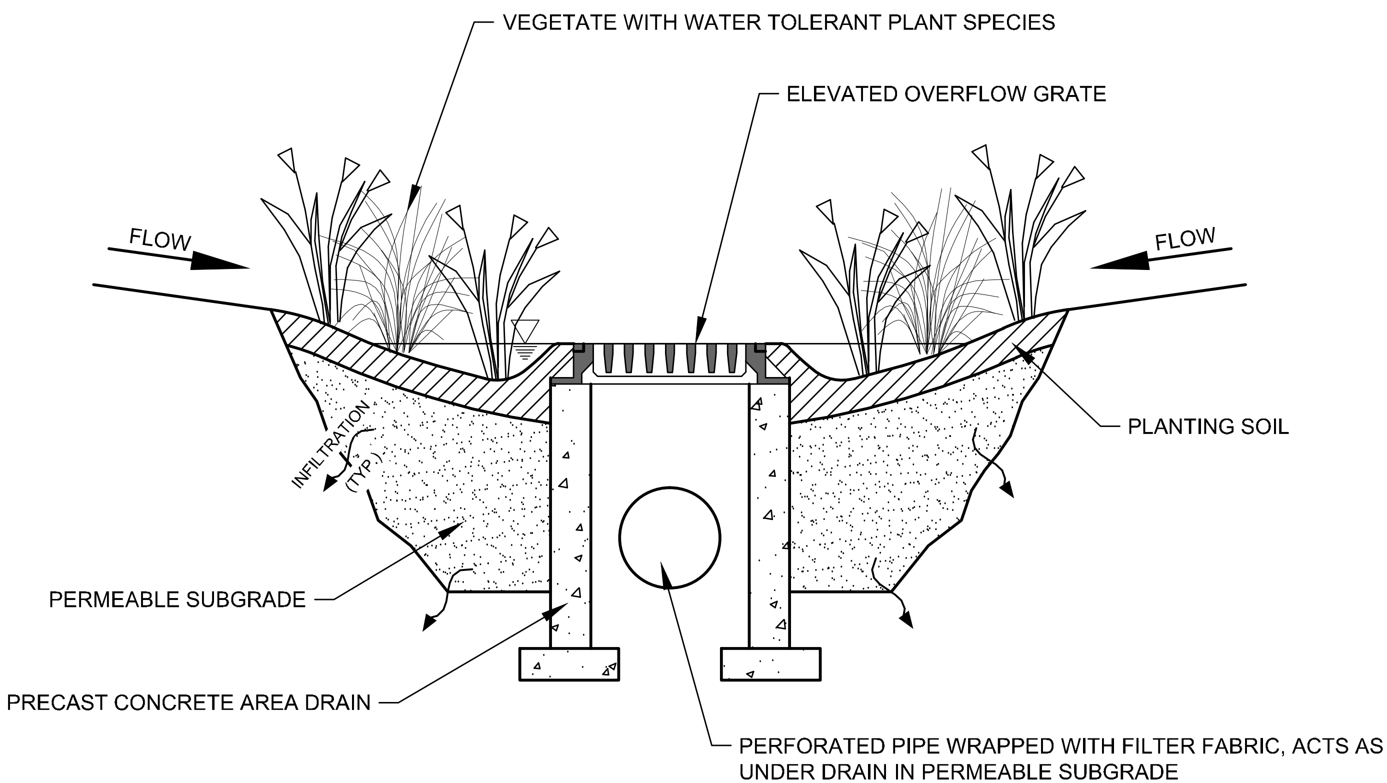
Environmental Planning & Consulting

APPENDIX F-2

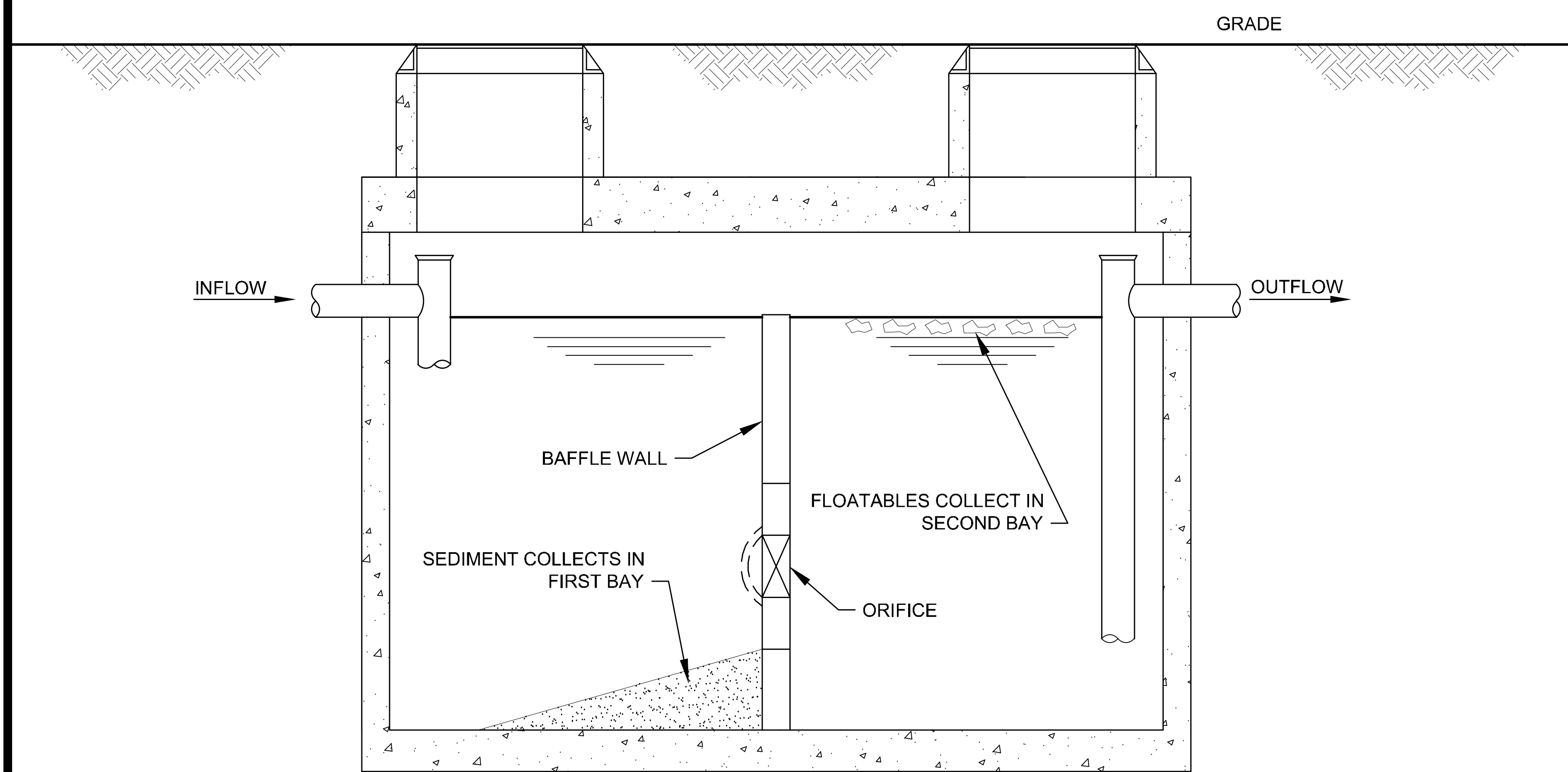
DRAINAGE DETAILS



DETAIL 1

BIO-RETENTION AREA / RAIN GARDEN DETAIL

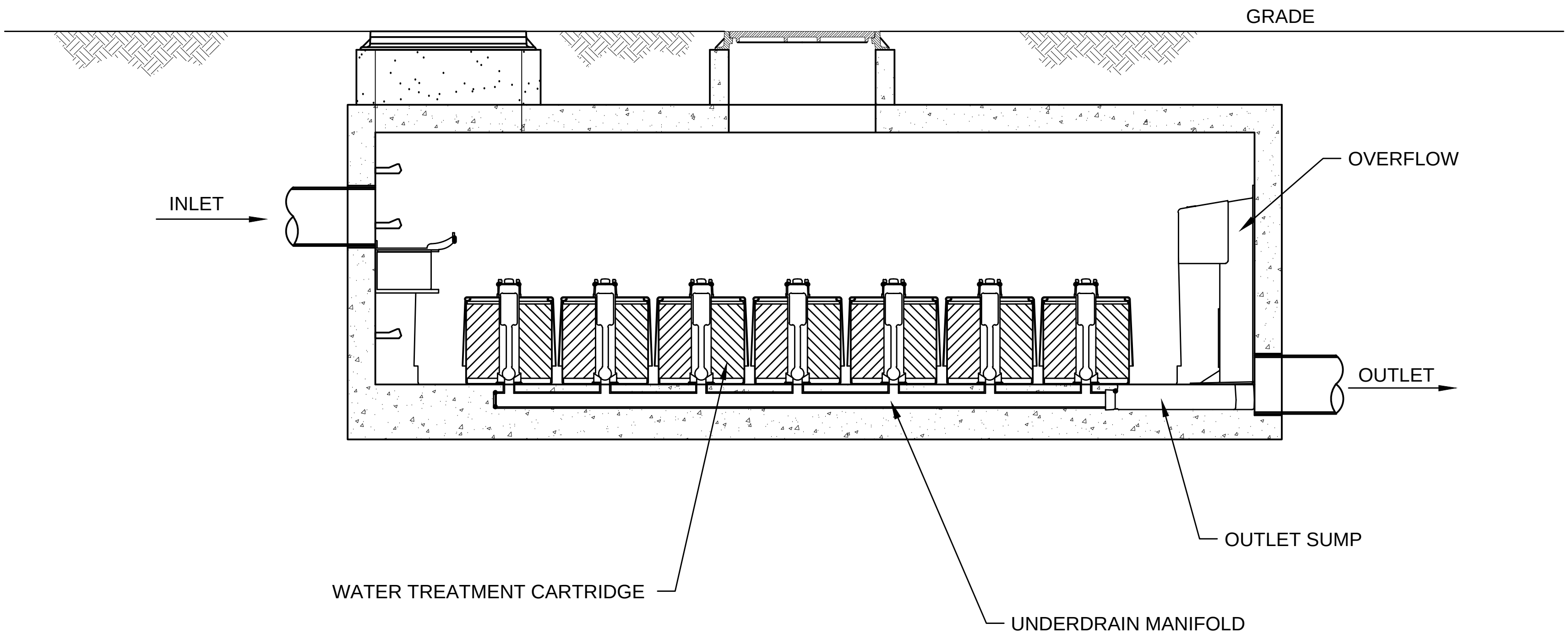
NOT TO SCALE



DETAIL 2 - TYPE 1

BAFFLED WATER QUALITY STRUCTURE DETAIL

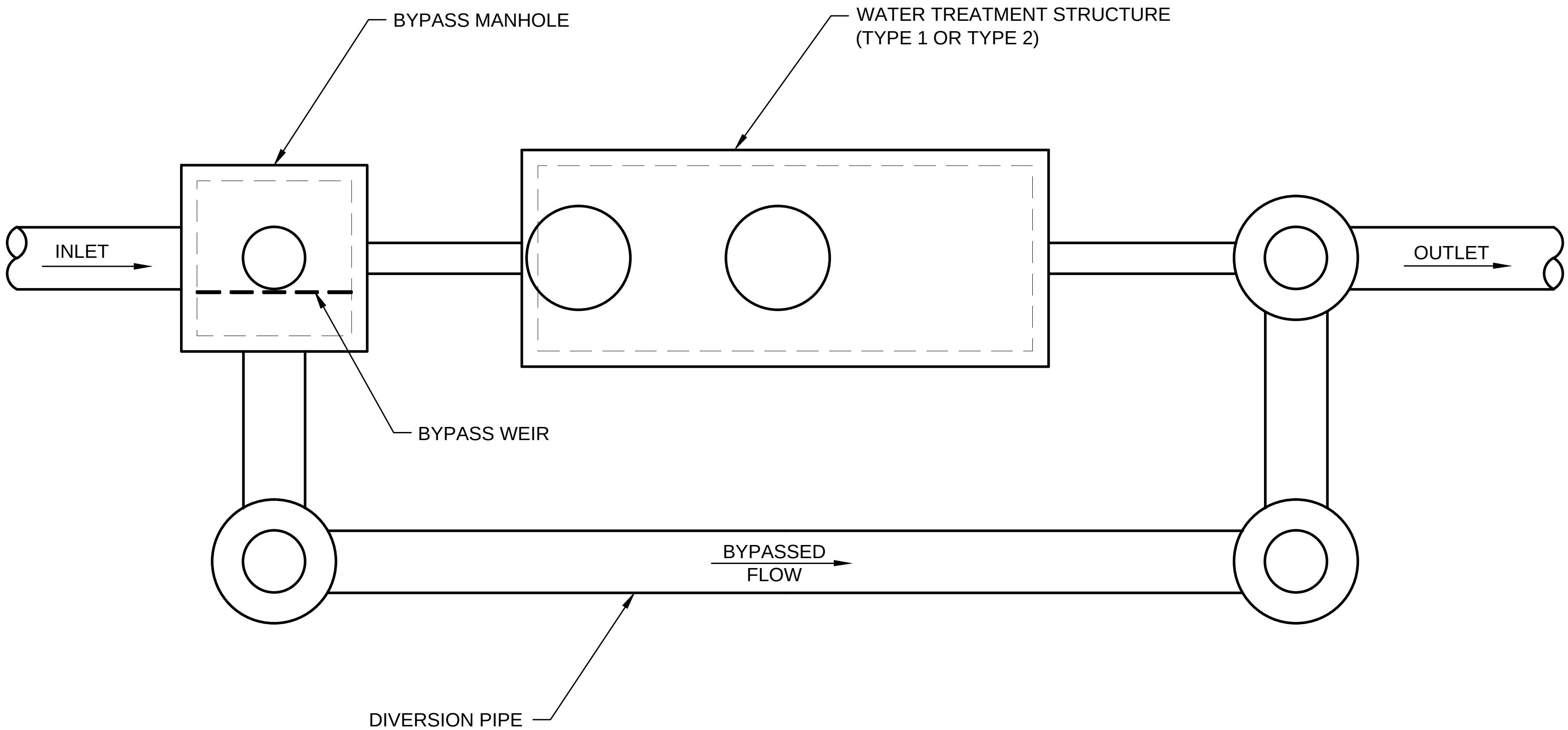
NOT TO SCALE



DETAIL 2 - TYPE 2

BAFFLED WATER QUALITY STRUCTURE DETAIL

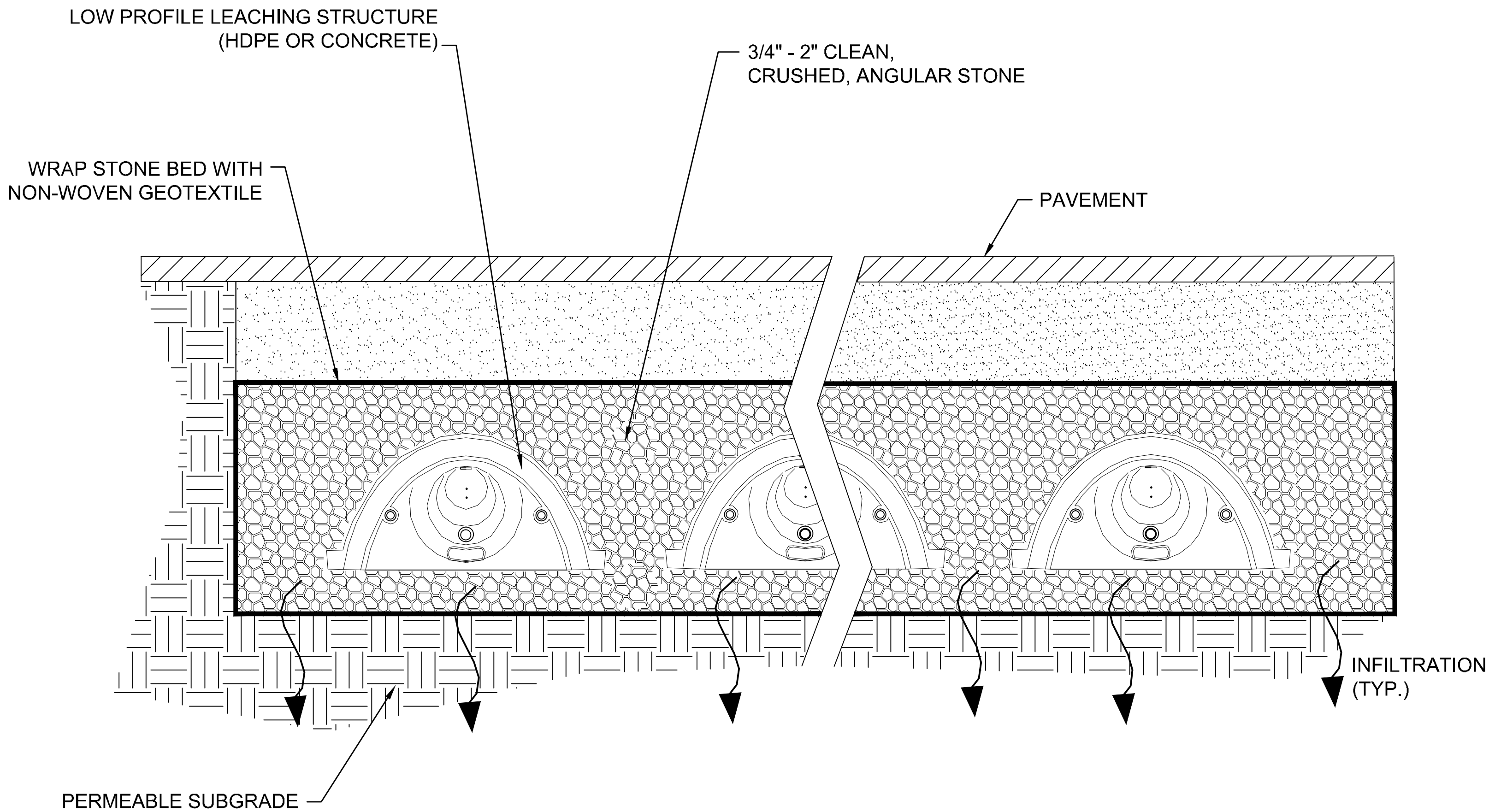
NOT TO SCALE



DETAIL 2 - PLAN VIEW

TYPICAL HIGH FLOW BYPASS

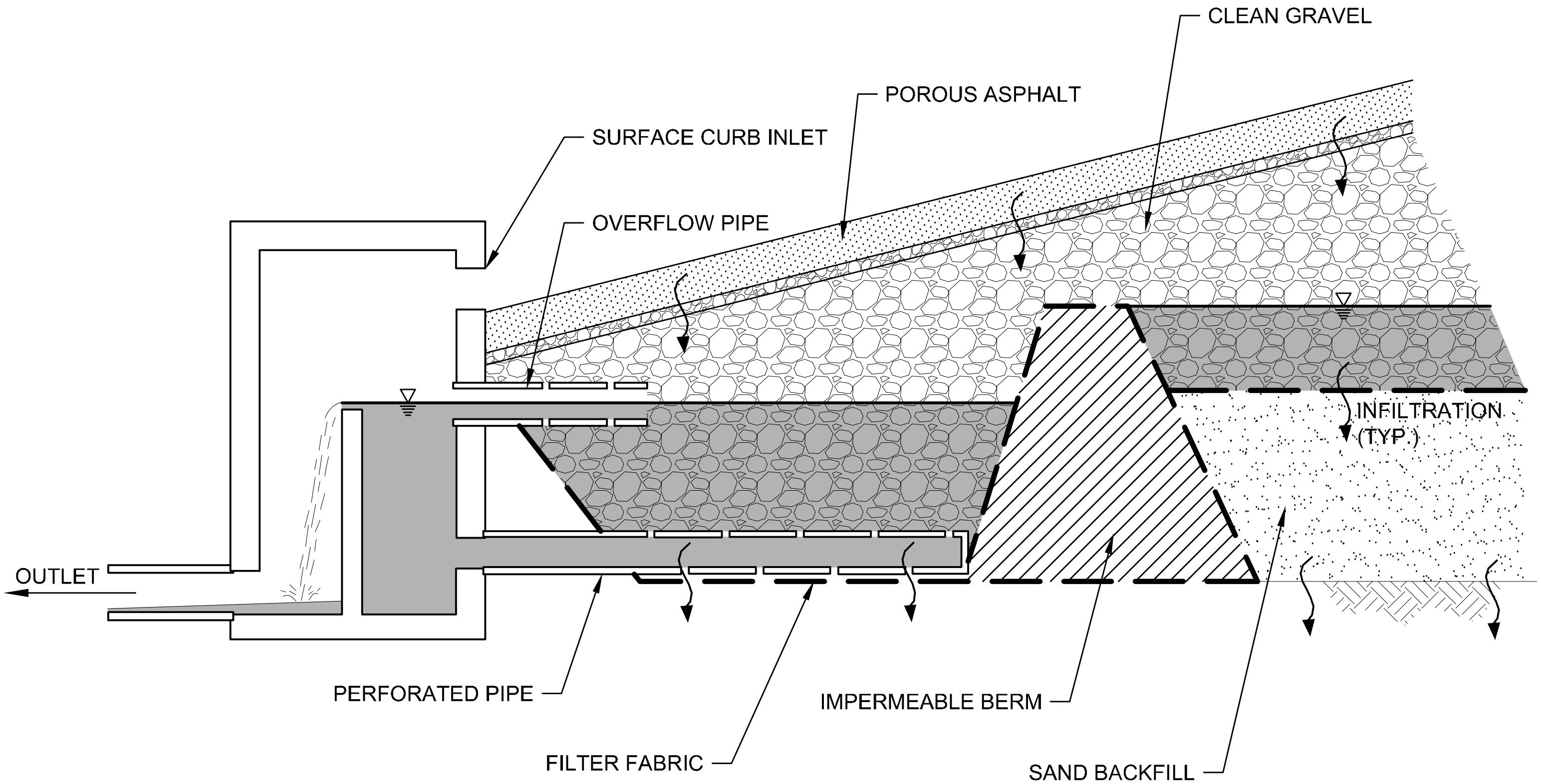
NOT TO SCALE



DETAIL 3

LOW PROFILE LEACHING SYSTEM DETAIL

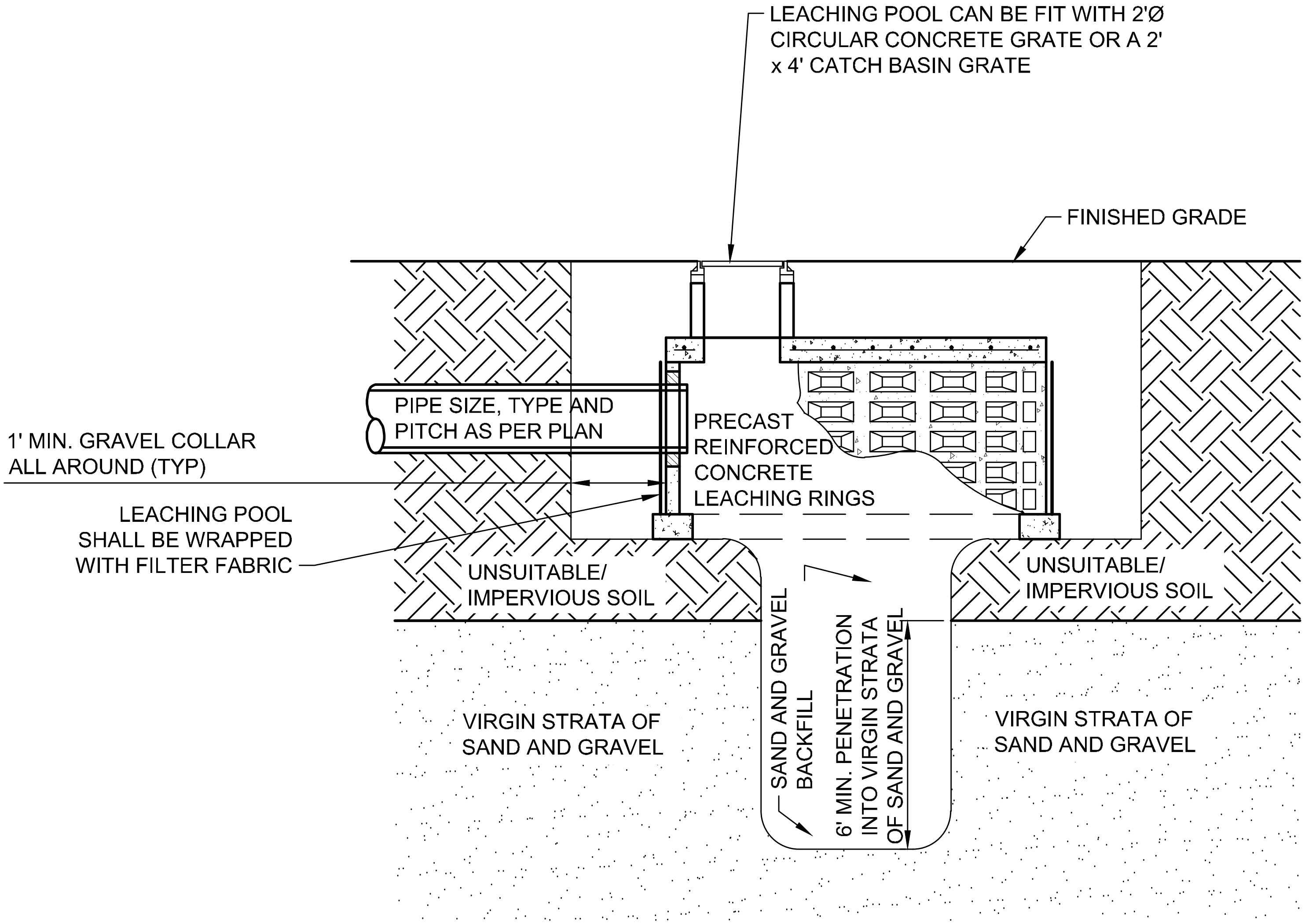
NOT TO SCALE



DETAIL 4

POROUS ASPHALT DETAIL

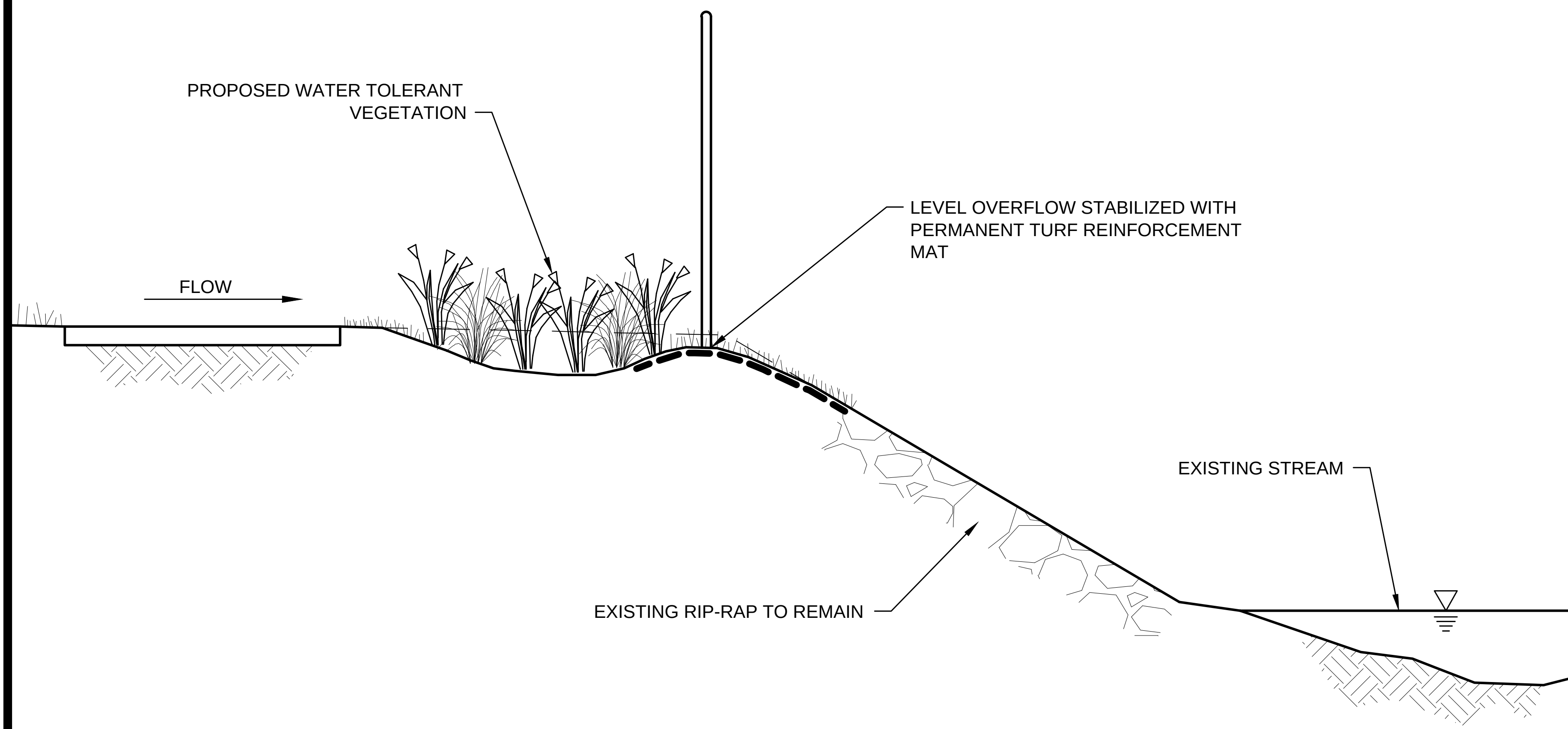
NOT TO SCALE



DETAIL 5

TYPICAL LEACHING POOL / LEACHING CATCH BASIN DETAIL

NOT TO SCALE



DETAIL 6

VEGETATED FRINGE DETAIL

NOT TO SCALE

APPENDIX G

SUMMARY OF PUBLIC COMMENTS

APPENDIX G - SUMMARY OF PUBLIC COMMENTS

A public hearing on the draft Watershed Management Plan ("WMP") was held on April 16, 2012. An overview of the draft WMP was presented, followed by an opportunity for attendees to provide their comments and questions. The following provides a summary of the comments received and a response to the comments is provided below.

Comment #1: Vic Consiglio (Massapequa) – Mr. Consiglio is the chairman for Operation SPLASH, an organization dedicated to cleanup of the Great South Bay ("Bay"). Operation SPLASH has been examining dissolved oxygen levels within the Great South Bay and has documented significant decreases in dissolved oxygen levels within the Bay, which are impacting spawning and survival of aquatic life. His organization is spearheading a project to help increase flushing of the Great South Bay, which he hoped the Town of Islip would support. The project proposes the installation of a large diameter pipe to connect the Bay to the ocean and allow for flushing of the Bay with each tidal cycle. Mr. Consiglio hopes that the Town would support efforts to pursue funding, permitting and installation of the pipe.

Response: The Town supports the concept of increased tidal flushing as a means to restore dissolved oxygen levels of the Bay. The Town Planning Department discussed Mr. Consiglio's pipe idea with the NYS South Shore Estuary Reserve Office and NYS Sea Grant. A representative from NYS Sea Grant indicated that they were aware of the Operation SPLASH pipeline idea and investigated the concept. Their preliminary investigation found that the amount of water that could be flushed through such a pipe is insignificant when compared to the overall volume of water in the Bay. Research into flushing of the Bay indicates that dredging of the Fire Island Inlet would allow for significantly more tidal flushing and is currently the preferred approach to addressing this problem. Federal funding to complete dredging of the Inlet is being pursued.

Comment #2: Anthony Bernardis (Sayville) – Mr. Bernardis questioned the need for the Great Cove Watershed Management Plan as there were previous studies completed for this area. He expressed concern about a stormwater pump station installed adjacent to his residence in Sayville, which may be impacting his property due to lack of regular maintenance. He is concerned that money is being spent on studies, but insufficient effort is being spent on necessary maintenance of the recommended improvements after they are constructed. He expressed that the Town needs to ensure there is communication with its consultants so that all relevant information is available during the preparation of planning studies. Mr. Bernardis also noted concern regarding possible expansion of the parking lots associated with the ferry companies, and noted that the ferry companies are using a RCA material to supplement stone within the parking areas that is not pervious to stormwater.

Response: The Great Cove WMP builds on previous work completed in the study area, including the 2003 Stormwater Outfall and Conveyance Identification and Mitigation Plan and subsequent efforts to identify and map the existing Town outfalls to surface water and the drainage collection and conveyance systems to these outfalls (see **Section 2.5** of the Great Cove WMP). The Great Cove WMP uses this data as a basis for identification and prioritization of conceptual stormwater improvement projects (see **Section 4.2** of the WMP). The WMP is not intended to be a detailed engineering design report; rather it is a planning study that identifies potentially suitable locations and drainage improvement concepts intended to provide water quality improvement. Each stormwater improvement project would require the completion of surveys, soil borings, detailed engineering plans and review prior to construction.

In addition to the identification of potential stormwater improvement projects, the WMP is an overall management plan that includes a comprehensive characterization of the watershed area, review of Town maintenance operations, recommendations for necessary updates to existing legislation, public education and outreach initiatives, as well as recommendations for municipal good housekeeping and best management practices for operations at Town facilities. The need for regular tracking and completion of necessary maintenance of stormwater systems is also a key recommendation of the WMP (see **Sections 3.1.1 and 3.1.2**). The Town Planning Department has directed Mr. Bernardis' comments regarding maintenance of the pump station adjacent to his residence on Terry Street to the Town's Department of Public Works and Town Engineer for further investigation. With respect to ferry operations and future expansion of the parking lots, a parking lot expansion would require site plan approval by the Town Planning Board. **Section 3.1.1** of the WMP includes recommendations for incorporation of stormwater best management practices and "green infrastructure" for both new development and redevelopment activities during site plan review.

Comment #3: Tommy Muir (Brightwaters) – Mr. Muir questioned if the WMP was going to be coordinated with the Water Resource Institute or similar institutional organization so that any water quality data collected could be used in larger or more regional efforts to understand changes occurring on the entirety of the east coast.

<u>Response:</u> **Section 3.1.8** of the WMP recommends establishing partnerships with SUNY Stony Brook for water quality monitoring. This recommendation has been revised to include the Water Resources Institute or similar research organization as suggested by Mr. Muir.

Comment #4: Robert Ford (non-resident, works in Islip) – Mr. Ford noted that there is a planted recharge basin in Islip (just south of Main Street and Marvin Lane), owned by the New York State Department of Transportation (DOT) which was very effective at capturing pollutants and floatables from entering the adjacent water. However, DOT has not maintained the basin in over 10 years, so the effectiveness of system has deteriorated. Mr. Ford also noted that maintenance of Vortex stormwater treatment systems is regularly needed.

<u>Response:</u> As noted in the response to comment #2, the Town concurs that regular maintenance of installed systems is essential to keep these systems efficiently operating. Section 3 has been updated to note maintenance is necessary for all stormwater improvement practices.

Comment #5: George Hoffman (Bay Shore) – Mr. Hoffman lives on Montgomery Avenue, adjacent to Bull Ditch Creek (just inside of Bay Shore Marina). During heavy rainfalls, the sewer manhole in his street overflows and runs directly into the storm drain that discharges to Bull Ditch Creek. He is also concerned with the amount of trash that ends up in Bull Ditch Creek after weekends in the summer from boaters throwing waste overboard, including sanitary wastewater, rather than properly disposing of it.

Response: The issue of sewer system overflows is discussed in **Section 2.2.1** of the Great Cove WMP and recommendations provided in **Section 3.1.5** include investigation of areas of reported overflows from the sewer system to determine the cause of such overflows (investigation of illicit discharges and sewer main cracks/infiltration, etc.). Recommendations in **Section 3.1.7** call for public education and outreach actions, including boat-owner education of proper waste/trash disposal and increased enforcement of littering and dumping activities (**Section 3.1.9**).

Comment # 6: Chris Burns (Cedar Avenue, Islip) – Mr. Burns asked how the meeting was advertized. He also noted his concern that pesticides and fertilizers are still permitted to sold and used in the Town, when these substances are known pollutants to surface and groundwaters.

Response: The public meeting was advertized in Newsday and local newspapers and notice was posted to the Town website, Facebook and Twitter. With respect to banning the use of fertilizers and pesticides, Suffolk County ("County") passed a law prohibiting the use of fertilizers from November 1st to April 1st each year. Additionally, the County adopted a Fertilizer Reduction Plan, which 1) bans the use of fertilizer on all County properties, with the exception of golf courses, athletic fields, the Suffolk County Farm in Yaphank, and where establishing new turf along public works projects; 2) established an Organic Parks Maintenance Plan, which limits fertilizer application rates to 3 lbs. of nitrogen per 1,000 sq. ft. over a golf course; 3) requires that all licensed landscapers take an approved turf management course to provide education regarding the proper use and application of fertilizers; and 4) requires retailers to post educational signage where fertilizers are sold to educate consumers about choosing fertilizers that pose the least harm to the environment. Similarly, the Town of Islip limits fertilizer use on Town-owned properties to organic protocols. Public education and outreach is essential to changing property-owners behavior regarding proper use and limiting use of fertilizer and pesticides. The Great Cove WMP includes several public educational brochures on property maintenance and retrofitting existing properties to reduce the need for fertilizers (see **Section 3.1.7** and **Appendix E**).

Comment #7: Jim LaRocco (Nassau County) –Mr. LaRocco echoed Mr. Burns comments regarding the need to ban the use of fertilizer. He suggested that the Town work with local nurseries and businesses regarding fertilizer use and as a network to educate the public. He suggested that the south shore municipalities should work together to bring about changes, such as banning the sale of harmful fertilizer. Mr. LaRocco noted that there is a need to improve information sharing between local and state levels, as well as make sure people are aware of studies underway and previously completed regarding water quality, so that money is spent efficiently and not in duplication of previous efforts or in repeating past mistakes. Mr. LaRocco pointed to the Southwest Sewer District and impacts to groundwater levels and stream flow as an example of learning from past actions. Mr. LaRocco is a member of Operation SPLASH, which conducts regular clean ups of the Bay. He indicated that there is a need to increase enforcement regarding littering and suggested that increasing the refund for bottle deposits may help encourage people to recycle them. He also supports public outreach and educational outreach to schools as a means to educate people on water quality issues and increase public awareness and interest in volunteer efforts aimed at improving water quality.

Response: With respect to banning fertilizer, please see the response to comment #6 above. **Section 3.1.7** of the Great Cove WMP includes recommendations to establish partnerships between the Town and County government, non-profit organizations, schools and the general public to provide opportunities for public education. This section as been revised to identify private sector businesses as another available partnership opportunity pursuant to Mr. LaRocco's suggestion. The Town concurs with Mr. LaRocco's recommendation for information sharing to reduce duplication of efforts. In preparing the **Section 2.0** Characterization Section of the Great Cove WMP, significant efforts were made to reach out to various state, county and local entities to obtain and summarize available water quality data. It is the Town's intention to make the Great Cove WMP available electronically, which may help others more readily locate the historical information compiled and summarized in the Great Cove WMP. The Great Cove WMP includes recommendations for public outreach and volunteerism, similar to the work Operation SPLASH has been successfully completing, as well as increased enforcement of littering and dumping activities (see **Sections 3.1.7 and 3.1.9**).